

AN EXPLORATORY STUDY OF
PROFESSIONAL DEVELOPMENT EXPERIENCES FOR
NEW MIDDLE SCHOOL SCIENCE TEACHERS IN
A SUBURBAN SCHOOL DISTRICT

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Doctor of Education

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

AN EXPLORATORY STUDY OF PROFESSIONAL DEVELOPMENT
EXPERIENCES FOR NEW MIDDLE SCHOOL SCIENCE TEACHERS IN A
SUBURBAN SCHOOL DISTRICT

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Dr. Jay Scribner, Dissertation Supervisor

ABSTRACT

This case study analyzed interview data for the perceived support of professional development provided to new science teachers by a large suburban school district. Twelve new middle school teachers and 5 administrators were interviewed. Findings suggested the most useful adult learning occurred in the learning communities model of professional development. Adult learning that used direct lecture and little teacher collaboration was found to be the least effective. The study recommends that districts provide better training to leadership regarding the delivery of quality learning communities, improve mentor selection and training, and provide new teachers with more quality feedback. The roles of leadership and relationships were interpreted as the most influential variables regarding whether or not new middle school science teachers felt supported through district-sponsored training. Educational literature on adult learning theories and quality professional development support this study's findings and conclusions.

CHAPTER ONE: INTRODUCTION

This dissertation is a qualitative case study that investigates the current status of professional development for new middle school science teachers in a suburban school district. Specifically, the study will assess how teachers are inducted and trained, how they perceive the value of the training, what barriers may keep them from implementing research-based teaching strategies and district initiatives into classroom practice, and what further assistance new science teachers feel should be provided.

The professional development of teachers is far from trivial. Guskey (2005) asserts that powerful professional development significantly improves the capacity of educators to help all students learn at high levels. In addition, following Knowles' (1980) theory of andragogy, it is imperative to view teachers as adult learners in order to make new information relevant and useful in the classroom.

The issue of training new teachers and inducting them into an organization is certainly not isolated to suburban school districts. Most districts have high expectations for teachers, and hopefully, they assume the responsibility of thoroughly training new teachers. This dissertation will attempt to understand how well district induction, mentoring, and professional development actually shape a new middle school science teacher's pedagogy and practice during their first years of teaching.

Explaining the Issues

Why Examine New Teachers?

In thinking back to the first years of teaching, one in the teaching profession can likely remember feeling frustrated with a lack of knowledge and skill regarding the

curriculum, understanding children, or designing lessons. Ideally, the mentor, team members, and administrators are there to guide and collaborate with the new teacher to help ease frustration. However, recent research on new teacher attrition has noted that while low pay and student discipline remain important concerns in the overall experience of new teachers, at the heart of the issue is a new teacher's relationship with administrators and peers. Inman and Marlow (2004) have researched teacher attrition and found that previous research on the topic focused on factors such as demographics, teacher background, and professional environment. They found that teachers left less often because of insufficient salaries, and more frequently because of a lack of professionalism, collegiality, and administrative support. New teachers want to feel successful and to be treated like professionals. The supervising administrators, mentors, and professional development trainers have an enormous impact on a new teacher's job satisfaction and decision to continue teaching.

There has been copious research on beginning teachers and teacher retention. Based on a 2000 NSTA teacher survey, half of all new teachers bid the classroom good bye after 5 years (Allen, 2007). Hope (1999) found that when educators, and new teachers in particular, cite reasons for leaving the teaching profession, they often include little or no administrative support and isolation from peers. Harrell, Leavell, and Van Tassel (2004) shared their results of a 5-year study which showed that new teachers left not because of a poor relationship with their teacher mentor, but because of problems with district administration and collegiality with peers. The data on teacher attrition and reasons for leaving are well documented. So what can a school do to retain high quality

teachers? Perhaps part of the answer lies in the relationships new teachers build during their induction process and professional development activities their first few years.

Ingersoll (2002) compares the process of continually training new teachers without retaining them to pouring water into a bucket with a large hole at the bottom. Slowing down the turnover of quality new teachers should be a top priority for principals who wish to create a stable culture and learning atmosphere for their students. Administrators must make new teachers feel welcome, supply them with resources, and be active partners in improving areas of concern. Shann (1998) found the strongest influence on job satisfaction to be principal support, because it influences teacher commitment, and in turn, teacher attrition.

The suburban school district on which this study focuses supports new teachers by filling professional development days and summer workshops with seminars and sessions led by experienced staff members. The trend of educators collaborating with other educators in professional development activities has drawn me to focus not just on new middle school science teachers, but also on their specific professional development needs. Does this type of teacher collaboration truly meet the needs of the new teacher? Retaining quality teachers while helping them improve their practice is a common goal for today's schools and worthy of research that seeks to understand the process.

Why Examine Middle School Science Teachers?

The role of science and mathematics teachers in the United States is crucial to creating generations of technology-savvy students for the future. Unfortunately, a shortage of well-trained, career-committed math and science teachers has created a vicious cycle for our nation. According to Darling-Hammond (2007), less than half of

first-grade through eighth-grade teachers are prepared to teach a balance of coursework in life, earth and space, physical, and environmental sciences. Nor do they have sufficient pedagogical knowledge about how to teach science effectively. If the specific needs of science teachers were better addressed through professional development, perhaps they would feel better prepared to tackle the science education of today's students.

As the primary researcher for this dissertation, and as a middle school science teacher for the last 12 years, I am naturally drawn to science education. Therefore, I have a unique perspective of the problems and dilemmas that new middle school science teachers face. Due to the developmental range of students, middle school science teachers have issues that both elementary teachers and high school teachers face. Young (2007) asserts:

Helping students construct science understanding through a more rigorous curriculum and the use of discovery and inquiry experiences requires teachers to understand far more about science content and processes than at present...Middle-level teachers may understand more science content (than elementary) but often have fewer skills in guiding learning through inquiry and discovery. (p. 28)

Much of modern-day science curriculum is based on inquiry. Ironically, as these inquiry methods build momentum and attempt to energize science education in the United States, the national movement towards standardized testing threatens to thwart such progress in science education (Jorgenson & Vandosdall, 2002). Many new science teachers start with little classroom experience and some lack the knowledge to implement inquiry type lessons. Allen (2007) believes teaching science requires the teacher to depart from the normal conventional teaching methods of textbooks and lectures. She believes a

combination of variables keep many new teachers stuck in a textbook. Lack of experience, knowledge, time for planning and self-reflection can all trap new teachers and keep them from incorporating more student-directed activities. I believe focusing time and resources to district induction, mentoring, and professional development programs for new science teachers impacts the overall pedagogical and practical teaching methods that teachers use during their first 5 years in the profession.

Another issue that works against middle school science teachers has been the way students are now tested over many curricular ideas from concrete to advanced concepts. Jorgenson and Vanosdall (2002) believe that trends toward high stakes testing, standards, and basic skill accountability in the areas of science, literacy and mathematics has caused a splintering effect of school curriculum, which therefore de-emphasizes science instruction and the use of inquiry based science instruction. “For example, American fourth-graders tied for second in science in TIMSS, but American eighth-graders fell to 17th” (p. 603). Berube (2000) agrees that “schoolchildren of all ages are failing science in record numbers. In particular, they are intellectually dropping out of science at the middle school level...” (p.321). Berube cites standardized multiple choice tests, memorization, and the developmentally backward way many teachers deliver the content as possible factors. She believes that middle school teachers should be focusing on concept development, but that many teachers themselves do not have the knowledge or skill to teach conceptual ideas in a developmentally appropriate way to students.

There seems to be a need to focus in on, and improve the type of, professional development training that middle school science teachers receive. The way that some teachers are delivering the curriculum does not always match that of current inquiry

based methods that are widely accepted to be best practice within current science education literature.

It certainly seems that science education has taken a back seat to some educational subjects, such as reading and math. In fact, Duschl, Shouse, and Schweingruber (2007) believe current middle school science practices go against what the current research recommends, based on the 2007 National Research Council report “Taking Science to School: Learning and Teaching Science in Grades K-8.” They found teachers today often separate teaching concepts from skills. Additionally, they found that the curriculum is often far too big with too many standards, and the curriculum is sequenced in a manner that works against the development of coherent learning progressions. Science teachers struggle daily with implementing multiple curricular and standards into a short time span, while others do not possess the knowledge or skill to effectively teach concepts in the classroom.

By combining the notion that many middle school science teachers lack the training and abilities to effectively lead inquiry-based learning with the idea that science teachers struggle with overloaded curriculum, it follows that professional development for these educators should focus on those areas. But is that happening in today’s schools? Are middle school science teachers getting the training to effectively improve their practices? Do they feel supported and knowledgeable in their classrooms? This study seeks answers to these questions.

Why Examine Professional Development?

Achinstein and Barrett (2004) studied 15 new teacher-mentor pairings over 2 years and found new teachers go through “practice shock” by transitioning from idealism

to reality. Therefore, new teachers need the full support of a district's ongoing professional development programs to increase their knowledge and skill so this "shock" is only temporary. If a teacher is struggling, it seems that there are three typical outcomes: the teacher can improve, he may move on after a year or two, or the school is stuck with a weak teacher. There seems to be only one financially and ethically appropriate outcome to support: the school should help the teacher improve. This is done through ongoing professional development, and it takes many forms.

New middle school science teachers interviewed in this study are in the same boat as most new, relatively inexperienced teachers around the country. Feeling overwhelmed by the expectations of parents and administrators and feeling the need to have a smooth-running classroom with high student achievement is a goal for all teachers. School administrators and professional development committees must consider providing new teachers with training in areas such as implementation of research-based pedagogies, classroom management skills, and student assessment techniques. The suburban school district examined in this study requires new teachers to attend several days of induction training before the school year begins, and each new teacher is also assigned a mentor. But is that enough? Should there be more professional development opportunities offered during the teacher's first few years in order to learn and discuss standards-based lessons, inquiry lessons, student developmental levels, and classroom management issues in more detail?

Finding out what teachers need is one of the most important steps when planning for professional development (McCarthy, 2005; Ricketts & Duncan, 2005; Serim, 2003). When teachers feel their needs are met, they are more likely to be engaged in professional

development and to pass on that learning to their students. Professional development and administrative support, or rather, a lack thereof, have been documented as reasons for increased teacher attrition rates (Ingersoll, 2002). Attrition of quality teachers is a major issue facing the American public school system. The price that school districts pay for teacher turnover is not only financial, but also one that students ultimately pay by having a revolving door of inexperienced teachers. Appropriate professional development is critical to improving these teachers' effectiveness. Understanding the current content and context of professional development for science teachers within a school district is a prerequisite when planning for initiatives and improvements within that middle school science department. Learning the perceived effectiveness of current district initiatives and the delivery of professional development activities is one of the research goals of this dissertation.

Rationale and Purpose

This study investigates the current status of professional development for new science teachers in a suburban school district. Research-based induction and professional development practices from the literature review will be compared with the district's current model of teacher induction and training. This dissertation aims to understand the perceived effectiveness of professional development for new middle school science teachers. It will be important to learn what specific barriers keep new middle school science teachers from implementing research-based and standards-based teaching techniques at the classroom level. The application, or lack thereof, of adult learning theories in new teacher professional development will be examined.

This study will assess the formal and informal ways teachers are supported in their learning of new information and implementing new pedagogies in their classrooms. Data collected from this study should provide public school administration, building administrators, mentors, and new teachers with qualitative data useful in planning for additional professional development opportunities in similar suburban school districts.

Research Questions

The research questions that guide this qualitative case study are:

1. What is the extent and content of professional development when training new middle school science teachers in a suburban school district?
2. To what extent do new middle school science teachers find district-sponsored, new teacher professional development to be effective?
3. How, and in what ways, do new teachers perceive that their training supports their teaching practices?
4. How can suburban school districts better prepare new middle school science teachers through induction programs (including mentoring) and professional development offerings?

The first three questions are addressed in Chapter Four: Presentation of Findings. I concentrate on the fourth question in Chapter Five: Interpretation of Findings.

Definitions of Terms

At the core of this study are the concepts of professional development and adult learning theory. For this study, I define *professional development* as any activity in which teachers engage for the purpose of gaining knowledge to improve their practice. I define *adult learning* as teachers adding to their core content knowledge, trying to improve and

better understand their practice, adding new information that changes their perceptions, and making changes to their practice based on that knowledge. The definitions of other terms relevant to this study follow.

Grade-level science plan time: Time provided on a weekly basis in the district's middle schools to allow the two or three science teachers for that grade level to meet and work together on curricular issues, lesson planning, and initiatives.

Grounded theory: "A specific procedure, associated with Anselm Strauss and Barney Glaser, in which the researcher collects data and does analysis at the same time" (Bogdan & Biklen, 2007, p. 272). Interpretations are derived inductively from raw data, and there is continual interplay between data and emerging interpretations (Fraenkel & Wallen, 2003).

Half-day professional development training: Monthly professional development in the district that takes place from approximately 11:15 a.m. – 3:00 p.m. when students are released early. This time is used for district-wide initiatives and professional development activities specific to each school building. It also allows each building to incorporate any other professional development that is needed to address the building personnel's specific needs. Principals are allowed time on these days to offer a wide variety of professional development activities based on the unique demographics of their teachers and students.

Induction program/training: The initial training of teachers at the start of each school year. First year teachers in the district are provided two weeks of training and induction on such issues as curriculum, assessment, classroom management, technology,

and time management. New teachers are also pulled out of the classroom once a month during their first year for additional collaboration and reflection time.

Inquiry-based teaching: “Incorporate strategies that are consistent with a constructivist view of learning. These strategies include active student engagement, authentic tasks, teamwork and collaboration, accommodation of learning styles, integration, and demonstrated skills and conceptual understanding (National Science Resources Center, as cited in Freeman, Marx, & Cimellaro, 2004, p. 112).

Mentee: A new teacher to whom a mentor is assigned.

Mentoring: District-assigned mentors are those veteran teachers with at least 5 years of teaching experience who work with new teachers over the course of their first year. Mentors attend a district-sponsored workshop during the summer for training and are then asked to complete a binder checklist, which includes multiple observations and meetings with the new teacher to discuss issues and improvement areas. Similar subject and grade-level mentors are assigned to new teachers whenever available. New teachers are more likely to acquire curricular knowledge, plan instruction, and reflect on practice when mentors are selected in the same subject and grade level and provided sufficient time to work with mentees (Youngs, 2007).

Middle school science teachers: The certified teachers being examined in this dissertation who teach sixth through eighth grade in the subject areas of Biological, Earth, and Physical Sciences.

National Science Education Standards (NSES): Present a vision of a scientifically literate populace. They outline what students need to know, understand, and be able to do to be scientifically literate at different grade levels. The standards address teaching

science, the professional development of science teachers, assessment, content, and programs (National Academy of Sciences, 1996).

National Staff Development Council (NSDC): The National Staff Development Council (NSDC) is the largest non-profit professional association committed to ensuring success for all students through staff development and school improvement. The council's purpose is ensuring that every educator engages in effective professional learning every day so every student achieves (NSDC, 2007). The NSDC developed 12 standards, divided into subgroups of context, process, and content. The standards were developed by experts in professional development and by representatives from several national education organizations. They set forth the elements of an ideal model for staff development that improves student learning (Guskey, 2003).

Needs assessment: Needs assessments can help individual schools find specific issues and problems that may be unique to the building level. Professional development offerings can spring from this. Research encourages needs assessments to be data-driven (Hayes & Robnolt, 2007).

New teachers/beginning teachers: For this study, this term is used to define teachers with 5 or less years of teaching experience within the school district.

Pedagogical content knowledge: Sparks (1997) describes:

That special knowledge and set of abilities that excellent teachers have. It's more than knowing content or how to teach in a generic way. It's understanding what aspects of the content students can learn at a particular developmental stage, how to present it to them, and how to lead them into different conceptual understandings. (p. 20)

Professional learning communities: Ferrara (2007) describes a systematic approach to reform in which schools:

Integrate multiple components with the school, link and integrate critical functions, promote a climate and culture for learning; build capacity, systems of practice, and professional community; provide opportunities for distributing leadership; and, accommodate, guide, and refine the indirect and direct influence that both administrators and teachers contribute to school improvement. (p. 20)

Standards movement: Loucks-Horsley (1999) describes:

A clear and sound emphasis on outcomes for students...more emphasis on identifying ambitious learning outcomes for students, observing and listening to students carefully to understand their thinking and grasp of important concepts, and developing a repertoire of strategies to help individual students learn. (p. 49)

Team plan time: Time provided on a weekly basis to allow all middle school teachers on a single team to meet, plan, and discuss team activities, student issues, and school or district initiatives.

Teaming: Strategy used in the district's middle schools that allow a group of teachers to share approximately 100 students who rotate core classes between a single group of teachers.

Transformational learning: "The transformational learning process involves questioning, critical reflection, and the need to engage in 'rational discourse' to gain consensual validation for a new perspective" (Mezirow, 1991, p. 168).

Contribution to the Field and Possible Beneficiaries of the Study

Quality teacher professional development is widely recognized as an integral aspect of supporting teachers in their education of today's children. This study will expand the understanding of the perceived effectiveness of professional development for new middle school science teachers. If administrators are to determine how best to incorporate professional development for the benefit of educators as a whole, then the professional development efforts for new teachers must first be understood.

Potential beneficiaries of this research study include: school district personnel, particularly those who work in suburban school districts, who plan professional development and train new teachers; new teachers, particularly in the area of science, who self-reflect and assess teaching strategies that grow from professional development opportunities; and me, the researcher, by gaining knowledge and experience while networking with district officials throughout the research process.

Limitations of the Study

This study is limited in at least three ways. First, only one suburban school district was studied. Second, the study examined a relatively small number of new science teachers (12) and administrators (5). In addition, the study addressed a specific group of new teachers in the area of middle school sciences, so results may not be generalizable to teachers of other subjects or to the training of veteran teachers. Third, data collection occurred over a short period of time from March, 2008 to August, 2008; interview responses were limited to those of the individual teachers who were within their first 5 years of teaching during that specific time frame.

It should be considered that because new teachers have a relative lack of work experience or current pedagogy, their responses to and reflections on the interview questions may be limited. Other limitations include my ability to navigate district politics in designing and carrying out interviews at multiple school buildings; and gaining participants' trust to respond openly to an unfamiliar person who may be viewed as an evaluator who might highlight individual teacher weaknesses.

Regardless, the study will likely have implications beyond the context of this school district and this specific teacher/administrator sample. It should provide an "in the trenches" perspective on how professional development is addressing teachers' needs. It should act as one research-based source that can be used in a broad research plan that addresses professional development issues. It may also enlighten some district officials regarding the role of adult learning styles and the means by which professional development is offered.

Overview of the Study

As the introduction explained, this study explores understanding the context and content of professional development for new middle school science teachers in a large suburban school district. The study looks to understand what type of content is provided to new teachers and how they perceive the usefulness of that content, the way that content is delivered, and how leadership and support groups assist and mentor new middle school science teachers trying to learn and acquire new information. The study examines the district's induction program, the mentoring program, science specific professional development opportunities, the barriers that prevent new teachers from implementing

new strategies, and the perceived types of adult learning that takes place during professional development activities.

I have divided this study into five chapters. In Chapter Two, I delve into a discussion on professional development. I examine both the characteristics of high-quality professional development programs and the factors contributing to their success. In the literature review, I also focus on adult learning theory and its role in the development of high-quality professional development. In Chapter Three, I offer an overview of the qualitative case study, the methodological approach that I used in this study. Chapter Four offers a detailed report of the findings. In Chapter Five, I interpret the findings and explain how information gathered and knowledge gained from this study can guide teachers and professional development organizers to better understand the context and content needed for planning high quality professional development opportunities to new middle school science teachers and all teachers in a large suburban school district.

CHAPTER TWO: LITERATURE REVIEW

Introduction

New science teachers have many challenges within their first 5 years of the teaching profession. Among them is making changes to their teaching practices based on professional development designed by their school district. As teachers learn to navigate around internal and external factors that inhibit professional growth, professional development designers must learn to recognize these barriers and find ways to effectively train and retain highly qualified teachers. Quality professional development is seemingly desired by teachers, administrators, district officials, and community members alike. But what works, what doesn't, and what training methods can be improved?

This chapter's literature review seeks information and research that address the following research questions:

1. What is the extent and content of professional development when training new middle school science teachers in Midwest School District?
2. To what extent do new middle school science teachers find district-sponsored, new teacher professional development to be effective?
3. How, and in what ways, do new teachers perceive that their training supports their teaching practices?
4. How can Midwest School District better prepare new middle school science teachers through induction programs (including mentoring) and professional development offerings?

Two primary lenses through which to view this literature review and my qualitative investigation are high-quality professional development and adult learning theory. The literature review will delve into the professional development needs of new teachers and of science teachers, specifically. I will review adult learning theories and their impact on the effectiveness of professional development.

While researching the literature on professional development for new science teachers, several themes repeatedly surfaced and will be elaborated upon in this chapter. These themes are: (a) the use of standards and inquiry-based constructivist pedagogy; (b) understanding teacher and student needs, including the barriers teachers face when implementing standards based professional development; and (c) the organizational culture that supports professional development. Before embarking on an in-depth analysis of high-quality professional development and adult learning theory, what follows is a brief summary of each of the recurring themes.

There is increasing pressure for accountability and adherence to state and national standards in science (Johnson, 2006). “The standards-based education reform movement sweeping through many countries is calling for high standards of learning, deeper thinking, centralized curriculum, aligned assessments, and consequential accountability...” (Freeman, Marx, & Cimellaro, 2004, p. 111). Unfortunately, the curriculum and teaching practices around the National Science Education Standards (NSES) are not being aligned very well at the classroom level. Standards for induction, professional development, and retention of science teachers are key factors for any reform initiative to be successful, but pre-service programs for teachers are falling short

in providing teachers with learning experiences to help them implement standards-based practices into their classrooms (Blackwell, 2004).

For professional development to make effective changes in educational practices, there needs to be a clear understanding of the barriers that teachers face (Johnson, 2006), as well as the teachers' needs. Curriculum reform studies identified technical, political, and cultural barriers and dilemmas (Anderson, 1996) that teachers face while implementing reform efforts. This framework helps examine whole-school and individual reform efforts for internal and external factors that relate to teachers implementing new innovations. Furthermore, a teacher's own pedagogical content knowledge is another key factor involved in diagnosing the problem of professional development needs of new teachers (Loucks-Horsley, 1999; Sparks, 1997). A teacher's own knowledge base must be addressed along with the teacher's understanding of how children learn concepts at each developmental level.

Organizations that train teachers may inadvertently create barriers by not providing the correct learning culture and organizational culture required for adult learning (Sunal et al., 2001). Allowing teachers to participate in professional development planning and ensuring adequate time to implement and discuss new techniques are only two examples of how an organization's culture can enhance teacher learning. To optimize what teachers will get out of new learning opportunities, it is critical to understand adult learning theory. Therefore, there are some organizational components that need to be addressed for effective professional development programs, and these will be addressed in my discussion of high-quality professional development.

Using these research-based themes to view the professional development of new science teachers within the school district at the nucleus of this research should help focus the discussion and findings towards recommendations for improvements. The following sections of this chapter will elaborate on the aforementioned lenses of high-quality professional development and adult learning theory. This will be important to understanding the interconnectivity that occurs when changing professional development opportunities within a school district, school, or classroom.

High-Quality Professional Development for Teachers

To help answer the research questions, the following section will review what researchers have shown good professional development to look like in public schools. Most models echo the type of conditions in which adults learn best. Guskey (2005) said, "...powerful professional development consists of highly effective professional learning experiences that accomplish their specified purpose: to significantly improve the capacity of educators to help all students learn at high levels" (p. 36).

Before delving into the characteristics of high-quality professional development, it may be helpful to note just who may be considered as professional developers or professional development planners. Boyd, Banilower, Pasley, and Weiss (2003) identified a wide spectrum of people who can serve this role. Teachers can be professional developers, as can their colleagues, heads of departments within a school, curriculum specialists, staff development personnel in a district, people from independent educational organizations, and/or college or university professors. It is also interesting to note that teachers can be, and often are, their own personal professional developers.

Professional development planners have a wide variety of choices of design models to train teachers. But in order to properly plan professional development, the school culture must be understood, a needs assessment must be undertaken, standards must be recognized, and appropriate models for professional development must be applied to enhance the outcome and teachers' learning (Guskey, 2005).

It is important to note that there is not one definitive professional development manual, nor is there a solid consensus regarding specific criteria or goals for an ideal professional development program. While most research shares similar themes, there are multiple variables and conditions unique to each school. It can, then, be difficult to follow a cookie cutter program. Also preventing the compilation of a single, all-encompassing professional development mantra is the fact that scholarly discourse may have different audiences. For example, political documents and teaching documents have different agendas, styles of writing, and lenses through which to view professional development (Guskey, 2005).

Research suggests that most teachers are not implementing reform, and many who are attempting implementation are not doing it well (Johnson, 2006). Teachers seem to be inadequately prepared in both content knowledge and scientific inquiry experiences for the task of implementing reform. Standards-based instruction is often neglected by teacher preparation programs, and is given little attention in professional development offerings by school districts. An even more obvious obstacle for a universal professional development blueprint is the fact that individual schools and districts can be so diverse in their professional development needs. For example, some schools may experience

economic stress with high numbers of new teachers, while others may lack adequate funds to implement any type of reform immediately.

Taking these concerns into account, my literature review has yielded a general consensus regarding characteristics of a quality professional development program. The key for each district, or even for individual schools within a district, is to consider not only these crucial characteristics, but also the individual needs of, and climate surrounding, the participants.

Characteristics of High-Quality Professional Development for Teachers

In searching for the perfect blueprint for a school's professional development model, one finds that the bulk of research has taken place within the last 10 years. Because of this relatively limited time span, researchers have varying opinions on the essential components of good professional development. Secondly, there seems to be a lack of research linking specific professional development characteristics directly to student learning outcomes (Loucks-Horsley, 1999). Even so, most educators would likely agree that improving a teacher's repertoire of skills through professional development activities is desirable for teachers, and ultimately, for the students they teach.

It is important to begin by trying to define the frequently bantered-around term of "high-quality professional development." High-quality professional development involves professional learning sessions that actually produce results in teacher learning or evoke changes in teacher practice (Mizell, 2007). Quality professional development often focuses on subject matter content and how students learn that content (Guskey, 2003). In addition, good professional development should also be consistent with other activities

and provide teachers with opportunities to actively interact and engage with each other around curriculum and instruction (Desimone, Smith, & Phillips, 2007).

In searching for the critical components or characteristics of high-quality professional development, one can not overlook the work of Guskey (2003). He analyzed 13 of the most noteworthy documents over 10 years and tried to compare the overlapping characteristic themes of effective professional development. These documents include the standards for professional development by the National Staff Development Council (NSDC). The results show only three themes common among all documents.

First, 11 of the 13 documents emphasized helping teachers to understand more deeply the content they teach and the way students learn that content. Second, ten of the documents list the importance of allowing sufficient time to deepen understanding, analyze students' work, and develop new approaches to instruction. The final common theme was the promotion of collegiality and collaborative exchange to build a sense of community.

Even though Guskey (2003) found only three major themes, his research cited many sub-themes or essential characteristics of professional development. These sub-themes should be discussed when planning professional development activities, as well. Worth considering are school- or site-based decisions, building leadership capacity, design based on teachers' identified needs, analyses of student learning data, follow-up activities, activities and models based on research evidence, accommodating diversity, opportunities for theoretical understanding, and reflection (Guskey, 2003).

School officials should look for answers to the following six questions when trying to determine if a school's professional development is high quality or not: (a) Are

participants clear about what they need to learn? (b) Are participants clear about how their practice should change as a result of their learning? (c) Are the educators actively engaged in their learning? (d) Are they committed to making change? (e) What is the school system's plan for reporting the school-based results of the professional development? (f) Did the school use the NSDC's Standards Assessment Inventory to determine if their system's professional development is high quality? The answers to these questions can help determine if professional learning is high quality (Mizell, 2007).

Even if professional development is considered high-quality, Miles (2003) suggests four things that need to happen for staff development to be effective. Teachers must use research-based curriculum and materials that are aligned with standards. A school must have a unified philosophy across classrooms in each grade and building. Teachers must work together and collaborate; and finally, the school must possess a culture to support adult learning and collaboration.

High-quality, effective professional development must incorporate an investigation of the entire structure, organizational variables, and policies that surround the professional development activities (Miles, 2003). Loucks-Horsley (1999) found that the quality of professional development consists of four clusters of variables: "content (what is to be learned); process (how content is to be learned); strategies and structures (how content is organized for learning); and context (conditions under which content is learned)" (p. 259). What follows is a brief examination of each of these four clusters of variables that are key components of high-quality professional development.

The content, or pedagogical content knowledge, refers to the teacher's understanding of subject matter material, learners and learning, and teaching methods.

Expert teachers understand "...what concepts in a discipline are most appropriate for students of a certain age, how the students come to understand those concepts, what native conceptions or misconceptions they are likely to have, and what representations, examples, and experiences help them learn" (Loucks-Horsley, 1999, p. 262). New teachers can acquire this expert level of understanding through study and reflection on their teaching practices.

The processes for effective professional development through which teachers learn best are: learner-centered, knowledge-centered, assessment-centered, and community-centered. The goal is to disturb a teacher's existing beliefs and practices in each of these areas to help them revise their thinking and pedagogy for new initiatives and changes (Loucks-Horsley, 1999).

The strategies and structures of quality professional development fall into five categories: immersion, curriculum, examining practice, collaborative work, vehicles and mechanisms. Immersion is when teachers actually experience their curriculum first hand. Curriculum is similar to immersion; teachers should actually learn concepts as the students will be learning the concepts. Examining one's own practice involves reflecting on teaching strategies, examining student work, and conducting action research to aid in delivering the curriculum to students. Collaborative work affords teachers the opportunity to share and build professional culture. Vehicles and mechanisms are the structures through which learning will occur. This includes workshops, institutes, and technology (Loucks-Horsley, 1999).

The last of the four variables of quality professional development is context. Context is another way to look at the values, assumptions, and culture that surround an

organization or school. The norms of collegiality, collaboration, and experimentation characterize schools that allow teachers to learn continuously. Successful schools set up learning-enriched environments where teachers interact frequently and daily work is tied into issues of teaching and learning. Inducting new teachers into this type of environment has been shown to increase student achievement (Loucks-Horsley, 1999).

Learning opportunities that are ongoing and sustained throughout the year can be effective in maintaining a skill set. Teachers are more apt to increase their learning and apply knowledge to their classrooms if their professional development is long term, focused on content, inline with their current knowledge and practice, includes opportunities for active learning and collaboration, and is related to their daily teaching lives. From a study of 88 southwestern schools participating in a reform initiative, Phillips (2003) found that one-shot training programs with no follow-up were not the answer when spending money and time on professional development. Teacher learning cannot just stop at the initial workshop. Districts must continue to provide support, ongoing training, and opportunities to observe, practice, and reflect on what they have learned. Schools need a paradigm shift to professional development that "...occurs every day on the job among teams of teachers who share responsibility for high levels of learning for all students" (Phillips, 2003, p. 242). Successful schools' professional development weaves together the qualities of research-based literature, shared leadership, and collaborative processes.

The duration of professional development may be one of the most influential factors linked to successful change initiatives. As previously mentioned, one-shot trainings with no follow-up or ongoing education are not ideal for effective, long-term

change. “Meaningful professional development must go far beyond learning to use a new piece of software or a new trick for increasing student participation. It must involve educators as whole persons—their values, beliefs, and assumptions about teaching and their ways of seeing the world” (Cranton & King, 2003, p. 33). Standards-based teaching practices linked with programs with durations of over 80 hours find the most success with teachers actually changing their instructional techniques in the classroom (Johnson, 2006).

Much of the research on high quality professional development suggests incorporating uniform standards to help with consistency and to focus on what students learn and do (Guskey, 2003). Those who design teacher professional development activities should first examine what research-based and professionally-recognized standards exist. The following section will detail some of the currently accepted standards for professional development.

National Standards for Professional Development

Many researchers insist that professional development be research-based and follow a set of standards set by the district or state. Many districts use the National Standards Development Council (NSDC) standards as a springboard to align professional development activities. The NSDC is the largest non-profit professional association committed to ensuring success for all students through staff development and school improvement. The council’s purpose is ensuring that every educator engages in effective professional learning every day so every student achieves (NSDC, 2007).

Standards that relate to student learning and achievement have been around for years. So before reviewing the NSDC professional development standards, it is important to understand the standards-based movement in American public education.

The standards-based movement has impacted every aspect of American schools and has a long history of existence. Implementation of standards-based curriculum at the classroom level is a critical step, and yet it is often the most difficult to manage, assess, and change (Guskey, 2005). DuFour (2005) explains:

The key to understanding the case for standards is to recognize that there are fundamentally only two ways to assess human achievement...we can either compare the performance to other performances we have observed, or we can compare it to an objective standard. (p. 4)

While standards-based curriculum has measurable advantages, there are concerns related to the movement. When district coordinators set too many standards and benchmarks, the amount of collaboration needed to achieve consistency can overwhelm teachers who are allowed limited plan time (Marzano, 2000). Furthermore, the standards and curricular benchmarks usually do not provide teachers with guidance on planning for information-based knowledge versus skill- or process-based knowledge.

Although this standards-based movement has been around for more than 50 years, it has just recently gained more popularity with the accountability placed on the shoulders of all schools from state and federal mandates. At the core of the standards movement is the answer to two fundamental questions: "What do we want students to learn and be able to do, and what evidence would we accept to verify that learning?" (Guskey, 2005, p. 36).

Similarly, professional development organizers have asked, *What do we want teachers to learn and be able to do, and what evidence would we accept to verify that learning?* Therefore, the NSDC developed 12 standards for professional development, and these are divided into subgroups of context, process, and content. The standards were developed by experts in professional development and by representatives from several national education organizations. They set forth the elements of an ideal model for staff development that improves student learning (Guskey, 2003). What follows is a brief summary of each area, based on information from the NSDC (2007) website for school districts and educators who plan for professional development.

The context standards concentrate on the concepts of learning communities, skilled leadership, and adequate resources that help set the stage for successful professional development. Teachers that are allowed to communicate and share ideas that are consistent with the goals of the school and district within learning communities have advantages over isolated individuals. Skillful administrators must guide the process of professional development and coach those involved at all levels. At the same time, resources such as time and budgets must reflect an emphasis on supporting ongoing professional development. These context standards lay the foundation for supporting teachers in their roles as life long learners.

The NSDC process standards help steer organizations to design professional development programs around data-driven, research-based practices that focus on collaboration among teachers. The process standards help teachers evaluate multiple sources of data, such as research on human learning and change, and help determine if that data can be applied to a specific setting and practice.

The content standards for professional development discuss teacher quality, equity, and home involvement. Teachers are asked to create equity in their classrooms by creating caring learning environments with high expectations for student achievement. High teacher quality consists of improving content knowledge and learning appropriate methods of assessing students. Teachers are expected to become proficient in finding ways to communicate and involve family and community members in the education of children.

These context, process, and content standards have helped schools plan professional development for the past decade, and still provide the current and future framework for many public schools. Through good professional development, teachers should apply new knowledge and ideas to promote student success.

But standards alone do not ensure the quality of professional development and student learning. They can, however, be used to help clarify and unify a set of fundamental expectations that can steer school districts in the right direction. Loucks-Horsley (1999) examined research on learning to teach to new standards and found five key points that teachers and professional development organizers should realize: (a) teachers' prior beliefs and experiences affect what they learn. If they believe teaching is telling and memorizing, then it can be a difficult process to challenge their beliefs and change them; (b) even when a teacher's belief system is in line with new reforms, a great deal of time is needed to develop new ways of teaching and assessing; (c) content knowledge is the key to understanding the context of the experiences and cognitive abilities of children; (d) teachers must have solid knowledge of children, their

ideas, and ways of thinking to interpret student work; (e) teachers need opportunities to reflect on their own learning and the application of new knowledge.

Even when schools use the NSDC standards as a starting point in planning professional development, why don't all schools find success? Research warns that when teachers collaborate on standards-based reforms, multiple perceptions and philosophies can make it frustrating to stay on task (Grossman, Wineburg, & Woolworth, 2001). When teacher philosophies differ, the goals of standards can differ, along with the approaches to achieving those goals in the classroom. Another obstacle that can waste collaborative time is debate over terms such as standards, goals, objectives, authentic assessments, benchmarks, and performance standards. Guskey (2005) tells a story of watching a professional development committee waste hours debating terminology when the focus should have been on learning and the learners. So even when most public schools have the essential research sitting in front of them, diversity and unique problems and needs can become obstacles for finding the right type of professional development to offer (Sirotnik, 2002). Yet, educational standards are not the only issue affecting professional development. Beginning teachers have their own unique set of concerns that are critical to consider in any quality professional development.

Understanding the Specific Needs and Difficulties of New Teachers

Among new teachers, one thing is clear: it's tough. Teachers who are within their first 5 years of teaching often deal with additional and/or different stressors, emotions, and daily survival skills. When school districts prepare professional development opportunities for staff, the needs of all teachers, old and new alike, must be valued.

Over the past 40 years, the eight most frequently perceived problems among beginning teachers were: classroom discipline, motivating students, dealing with individual differences, assessing students' work, relationships with parents, organization of class work, insufficient materials and supplies, and dealing with problems of individual students (Nielsen, Barry, & Addison, 2006). Blackwell (2004) asserts:

Current education curriculum falls short in what first year teachers need to know, according to project reports. Experienced teachers in professional development schools across projects indicated that prospective teachers need additional study in: a) development of at-risk students, special needs students, and students of poverty; b) cultural differences; c) building relationships with parents who are in crisis; d) critical thinking and questioning; e) the interactions between teaching and learning and theory and practice; f) the links between instruction, assessment, and student learning; g) standards and reform; and h) collaborating with community. (p. 43)

Mid-career teachers who enter the field of education with previous work experiences have unique characteristics that may differ from their younger new teacher counterparts. Johnson and Birkeland (2003) explained:

...mid-career entrants were more than three times as likely as their first-career counterparts to move from one school to another. This comparison suggests that, as a group, they were fickle or unstable. However, our data suggest that those with prior career experience--often in higher-status and better-resourced lines of work--were less tolerant of schools that did not support good teaching. (p. 560)

“Mid-career switchers often bring to the classroom strong subject-matter competence and mature job skills, but they lack knowledge about and experience with students, curriculum, pedagogy, and the daily routines of schools” (Johnson & Kardos, 2002, p. 14). So while mid-career teachers could perhaps identify when ideal conditions and support were not happening, they may still struggle with their own needs and dilemmas.

These findings cast a gloomy picture for the start of a teacher’s career. In trying to address these perceived problems, researchers in the field of professional development have developed programs specific to boosting new teachers’ success. These programs typically include new teacher induction, mentorship, instruction methods, and classroom management, as well as teacher evaluations. In induction program offerings, school districts must try to address as many new teacher needs as possible.

The importance of new teacher induction. When an individual begins a new job, it is quite commonplace to go through a training or induction process. For educators, it is no different. Many researchers believe that new teacher induction programs and policies help reduce teacher attrition and assist teachers to move beyond worrying about student behavior to focusing on student learning (Ingersoll & Smith, 2004; Nielsen et al., 2006). Teacher induction refers to the time when teachers adjust to the roles and responsibilities of being a classroom teacher. New teacher induction programs can include a multitude of elements, including orientation, reduction of work load, release time, professional development activities, collaboration with colleagues, teacher assessment of students, program evaluation, follow-up, and mentoring (Horn, Sterling, and Subhan, 2002).

Professional development planners must use the time during the first few weeks and months to help new teachers understand the culture and pedagogies of the district.

Professional development for new teachers should be built on a framework of research-based instructional strategies that fall into three categories: organizing, instructing, and assessing (Freiberg, 2002). According to Wong (2002):

The best (induction) programs kick off with four or five days of workshops before school begins. They offer new teachers systematic training over 2 or 3 years.

They have administrative support. They integrate a mentoring component and a structure for modeling effective teaching during in-service and mentoring experiences. They also include opportunities for inductees to visit demonstration classrooms. (p. 52)

The induction programs focus on skills such as classroom management and instructional practices, and acculturate new teachers to the mission and philosophies of the district.

Johnson and Kardos' (2002) multi-year study of 50 new teachers in Massachusetts found that what new teachers want in their induction is:

...experienced colleagues who will take their daily dilemmas seriously, watch them teach and provide feedback, help them develop instructional strategies, model skilled teaching, and share insights about students' work and lives. What new teachers need is sustained, school-based professional development--guided by expert colleagues, responsive to their teaching, and continual throughout their early years in the classroom. Principals and teacher leaders have the largest roles to play in fostering such experiences. (p. 13)

High-quality induction programs have some common characteristics. They are highly structured, focus on professional learning, and emphasize collaboration (Wong, Britton, & Ganser, 2005). Quality induction must set clear goals and expectations for which the new teacher strives. Common language and clearly articulated standards of professional practice must be used throughout the induction process by mentors and professional development trainers to help new teachers set goals, reflect, and evaluate their own teaching practices (Moir & Gless, 2007). In addition, school officials should conceptualize induction as involving multiple individuals in the support and training of new teachers. It is not as simple as assigning a single mentor and assuming that one person will take care of any issues that arise. District policy must provide language that allows district administrators, principals, mentors, and colleagues to share in the responsibility of helping new teachers acquire curricular knowledge, planning of instruction, and reflecting on practice (Youngs, 2007).

Wong et al. (2005) summarize the findings of five other countries' new teacher induction programs. They suggest that the education profession in the United States systematically places the responsibility for assisting new teachers on just a few people, and there is an overarching assumption that new teachers have deficiencies of skills. On the other hand, the other countries in this assessment tended to view new teachers more as professionals. They offered more collaboration with larger groups of people among the school building that shared responsibility for assisting the new teachers for many years. For example, groups of teachers in China observed each other's classrooms eight times a semester to discuss practices. New Zealand seemed to have the most staff members involved in assisting new teachers. New teachers were provided 20% release time to

participate in the advice and guidance program. Furthermore, other countries seemed to focus their efforts on small groups that met with the new teacher rather than just one mentor or supervisor (Wong et al., 2005).

It seems that if schools wish to produce leaders, having a quality, sustained teacher induction program is the first step. This can help make the new teacher feel success and that she is wanted and respected as a professional. Reduced attrition rates can be attributed to schools that have an organized, sustained teacher induction program. Mentoring is a key component of a high-quality induction program. It should be noted that “mentoring alone will do little to aid in the retention of highly qualified new teachers. However, as an integral component of a structured induction program, it can be valuable” (Wong, 2004, p.107).

The impact of mentors and need for collaboration with new teachers. What makes a good mentor? Youngs (2007) shared that:

Research on teacher development, induction, and policy implementation indicates that new teachers’ experiences are shaped by district induction policy (i.e., district policy related to mentor selection, assignment, training, and work conditions); other district and school contextual factors; and educator’s understanding of induction and related reforms. (p. 801)

Assuming that a district has the proper structures and policies in place for making sure every new teacher is provided a mentor, the real question should be how to select and train mentors to be the most effective.

Mentors are not simply colleagues. Mentors should be selected based on certain personal and professional qualities. A mentor must have strong interpersonal skills, be

respected by the administration, demonstrate curiosity and an eagerness to learn, show a respect for multiple perspectives, and possess pedagogy that all students can learn (Gless & Moir, 2001). The mentor must then participate in training for establishing trust, identifying the needs of the new teacher, using assessment data to guide the support process, incorporating adult learning theories, and using strategies for actively engaging participants. Ample mentor training sets the stage for promoting the organization's culture and beliefs to help guide the new teacher through the difficult and confusing first years.

Mentoring includes dispositions and beliefs, conceptual and theoretical understanding, as well as skills for implementing the practice (Odell & Ferraro, 1992). A mentor must have specialized preparation and commit to spending a significant amount of time working with the new teacher. Helping the new teacher learn the ropes and addressing student behavior is just a small part of the mentor's job. The array of topics that must be discussed range from classroom management, effective lesson design, grading, parent communication, and cooperative learning. Parsons and Nyi (1999) say mentors must be prepared to help new teachers understand cultural issues, and work on curriculum and instruction issues.

But simply assigning mentors does not produce leaders. And mentoring alone is not enough. "The reality is that after more than 20 years of trying mentoring as a means of helping new teachers, there is no substantive research supporting its efficacy" (Wong, 2004, p. 109). That is, if mentoring is the only means in place to help the new teachers, there could be problems. Producing leaders means allowing new teachers to observe others and to network with study groups in a sustained, structured program while also

joining learning communities to gain knowledge. The mentor is just one piece of the puzzle.

In a study that examined 15 new teacher-mentor pairs, the term “practice shock” was mentioned. Practice shock was described as a new teacher’s desire to control students while dealing with his or her own inability to frame student needs (Achinstein & Barrett, 2004). Researchers have noticed that new teachers going through practice shock tend to have a hard time understanding the needs of the students. Mentors that help frame issues as managerial, human relations, or political can help new teachers understand student diversity as a positive aspect of reality rather than an obstacle.

Collaborating with a mentor is a rite of passage that hopefully benefits both new teacher and mentor. Professional development planners and principals who assign mentors must make sure mentors are properly trained and prepared and are well-matched to the new teacher’s subject area. The mentors must not only have a desire to help new teachers learn the ropes, but must also challenge their pedagogical beliefs in order to reflect back on student performance in the classroom. Mentors can also play a key role in helping beginning teachers learn about a school’s culture.

School Culture’s Role in Professional Development

Without a supportive environment, even good professional development opportunities for teachers can become less effective. Significant classroom changes can first begin with the school’s culture. Once a school thoroughly understands the characteristics of and the standards associated with high-quality professional development, a needs assessment might reveal that teachers have a particular perceived

weakness. When the school implements professional development that aims at changing or correcting the weakness, it must fit into the current culture of the school.

Current research indicates that teachers who work together to solve problems or to change practices have an advantage over teachers working in isolation (DuFour, 2005). In order to build such a culture of collaboration, leaders must not forget to inspire and address “matters of the heart” by pointing out successes along the way, celebrating, sharing stories, and reminding teachers why they decided to teach in the first place.

New teachers fall into three types of working cultures: veteran-oriented, novice-oriented, and integrated cultures (Johnson & Kardos, 2002). Veteran groups were found to alienate new teachers while novice groups often floundered in chaos. The integrated group was more collaborative with a mix of both veteran and novice teachers who took their cues for collaboration from principals. Johnson and Kardos (2002) reported:

New teachers who found themselves in integrated professional cultures described their principals as visibly engaged in both the daily life of the school and the professional work of the teachers. These principals focused on the improvement of teaching and learning, visited classrooms, and provided feedback. They arranged school schedules so that expert teachers could teach model lessons or meet with new teachers one-on-one or in small groups. They helped teachers prioritize professional goals, recommended conferences or institutes that teachers might attend, and cultivated a professional culture in which teachers were collectively responsible for student and teacher learning (p. 15).

A collaborative school culture can result in some innovative ideas. An example is one in which a principal created flexible schedules so teachers could have daily or weekly

work time called “personal learning time” (Phillips, 2003). The concept allowed individual teachers to decide if they needed to spend the time on collaboration, research, or reflection time. Outsiders may question the accountability of such an unstructured design of professional development, but Phillips found that when teachers took ownership for making decisions for themselves, it fostered a culture that treated teachers as leaders. This ownership in decision-making at the building level is key in developing a professional learning community. When organizations try to implement these types of learning organizations, there must be a supportive leadership structure which allows for flexibility and diversity.

The type of leadership structure within an organization can greatly affect that organization’s ability to create innovation and a type of culture that incorporates the needs of individual teachers and buildings (Nonaka & Takeuchi, 1995). Middle-up-down management is highlighted as a way to incorporate unique cultures and differences in large organizations. Businesses, and organizations like schools, often have a tendency to pass down directives from top leaders, which may lead to disconnects between the organization’s vision and what actually occurs at the worker or classroom level. “Middle managers [principals] try to solve the contradiction between what top management hopes to create and what actually exists in the real world” (p. 129). Therefore, empowering the middle and lower level employees with decision-making mechanisms can help stimulate true innovation and increase both productivity and knowledge creation for individual schools and teachers within large districts.

The best chance to change teaching practices at the classroom level is to have powerful, ongoing, job-embedded professional development that clarifies what students

should learn and be able to do (Caine & Caine, 2000; Guskey, 2005; Sparks, 2003). Additionally, Mohr and Dichter (2001) found that to build learning organizations that foster teacher leaders, a shared decision-making model of professional development was required.

Building the capacities of school leaders through collaboration and building relationships is vital in order for the community of learners model of professional development to have positive results. Michael Fullen's (2004) book, *Leadership & Sustainability*, describes that organizations who want to reform need leaders at all levels of the system that will proactively and naturally interact with larger parts of the system to help produce other leaders to work on the same issues (DuFour, 2005).

The success of new teachers lies "primarily at the school site...[and] principals proved to be key in determining the extent of collaboration" (Johnson & Birkeland, 2003, p. 586). So it seems that new teachers have more success with school leaders who get involved with new teachers and encourage collaboration. School leaders should consider developing an entire culture around the new teachers rather than just sending them to periodic workshops.

Understanding school culture starts with shared beliefs and values that school administrators and teachers must already have in place. Shared decision-making and collaboration on job embedded issues on a daily basis will allow teachers to become leaders and take ownership of their professional development. If the professional development components discussed in previous sections are not rooted within a school's culture, school initiatives become harder to sustain over time within the organization.

Examples of Models for Implementing High-Quality Professional Development

Once professional development planners understand the role of culture in implementing new professional development opportunities, it begs the question, “What do the training designs actually look like?” In the past, the traditional method of professional development was a one-shot training that occurred in a very short time frame and lacked the design factors and characteristics for lasting change and improvement. Schools looking to apply high-quality professional development should incorporate a durable method of professional development that is both technically and socially innovative. Wells (2007) lists ten design factors associated with effective models of professional development: (a) evaluation driven; (b) contextual and relevant; (c) learner-centered; (d) duration of process; (e) active engagement; (f) inquiry based; (g) theory and research based; (h) collaborative; (i) supported technically and socially; and (j) sustainable. This section will provide three examples of professional development models that encourage this kind of long-term learning and teacher growth.

Professional development pathways model of professional development. The professional development pathways model, described by Lieberman and Wilkins (2006), can be effective if schools incorporate the necessary policies to support the new practices of the model. This model has three steps: assess the need, determine appropriate professional development pathways, and reflect. Assessing the need involves consulting state requirements, the school’s improvement plan, and conducting needs assessments for individual needs while looking through the lenses of adult learning theory and developmental levels. Selecting appropriate pathways requires schools to choose professional development activities based on the needs assessment while aligning them

with curriculum standards and providing teachers with the appropriate context and content to learn and share knowledge. The purpose of the third step, reflection, is to emphasize the relationship between the professional development and the impact on student learning. Teachers need to be given adequate time to reflect upon what they have learned and how to implement, adapt, or change based on that learning.

Positive deviance model of professional development. Another implementation method that some schools have chosen for delivering professional development to staff is what Sparks (2003) calls “spreading positive deviance.” This involves having your best teachers share their knowledge across the school and district. One drawback to this, of course, is that the best teachers sometimes give up class time to put on workshops or to observe other schools, but the concept helps support the community of learners model, which will be discussed next. The goal of asking these teachers to lead professional development sessions is to reduce the variation of practices across classrooms in the same school and district. This model of professional development implementation is just one small part of the overall culture that must exist for substantial change to occur.

Problem based learning model of professional development. Another type of professional development delivery method that has been widely used in the nursing and medical fields is Problem Based Learning (PBL). But educators can utilize PBL as a way for teachers to continue growing through professional development. Clossen (2008) explains that PBL involves presenting problems to small groups of learners who draw upon their collective skills to help solve problems. A trainer or group leader helps the small group identify problems, make hypotheses, and apply new knowledge. Successfully pulling off PBL can take skill and a special type of culture.

Bruffee (1995) shares that learning in small groups in PBL requires a process called reacculturation. Before PBL is attempted, the small groups must understand two heads are only better than one if the group understands learning together is something we must first learn how to do. Bruffee (1995) states:

Students learn by joining transition communities in which people construct knowledge as they talk together and reach consensus. What teachers do is set up conditions in which students can learn. And one of the most important ways teachers do that is by organizing students into transition communities for reacculturative conversation. (p. 13)

So, teachers must be open to thinking about different ideas from the group and then be willing to change their practice. The non-foundational learning that occurs in PBL may frustrate some learners because it is not a concrete learning of facts, but is more open-ended, must be interpreted in a social context with many different opinions, and has multiple possible correct answers (Bruffee, 2002). Educators must help learners not to discriminate or devalue diversity in group learning, but to embrace those differences as well as similarities. Helping small groups of teachers negotiate social learning through PBL can be a beneficial use of professional development time for school districts who take the time to set up group expectations in a supportive environment.

Professional learning communities model of professional development. The most widely-discussed model of professional development in the current literature is called the professional learning communities model. Ferrara (2007) believes that the best model for professional development is one that tries to improve or transform schools into professional learning communities. In professional learning communities, teachers work

together to create consistency of standards from teacher to teacher in the same grade level and other schools within the district. DuFour (2005) urges schools to abandon the traditional method of contracting an outside professional development speaker who is brought into staff meetings once a month. Rather, schools should embrace the notion of daily or weekly work time for teachers to collaborate with each other in planning for, creating, and implementing standards-based curriculum (Miles, 2003; Wong, 2004).

“The professional learning community framework for school improvement begins by working together to develop clear academic goals, frequent assessment of learning, a more collaborative culture, and a focus on results” (DuFour, DuFour, Lopez, & Muhammad, 2006, p. 54). Within the learning community model, the term leaders is not necessarily hierarchal in nature, but is being reframed to mean staff members who work together to foster collective learning. Becoming more involved in continued discussions about beliefs and practices when creating and sharing knowledge is the foundation of a culture that supports the learning community model of professional development (Caine & Caine, 2000).

When setting out to improve schools, the deficiencies are seldom the result of a single weakness or poor instructional programming. Professional learning communities look to resolve systemic weaknesses in leadership, culture, and decision making at all levels of the school. A professional learning community addresses the areas of design, planning, and implementation, and evolves into normative practices. Design, planning, and implementation all require a culture that allows teachers to have ownership, share pedagogical ideas, and set standards for curriculum, as mentioned in the previous section. Collaboration must persist throughout the process, as should data-based and research-

based decision making. The learning communities model seems to match the type of culture and standards that allow teachers to make lasting changes to their knowledge and practice.

There are three basic ideas that differentiate professional learning communities from traditional schools. First, every teacher believes that every student will learn, and if a student slips, the school has an immediate plan of action for that student. Second, a culture of collaboration is developed in which teachers work together to analyze and improve their classroom practice through ongoing cycles of professional development for themselves and each other on the team. Third, “professional learning communities judge their effectiveness on the basis of results. Working together to improve student achievement becomes the routine...” (DuFour, 2004, p. 10).

No model is perfect, and DuFour (2004) is bothered that schools and districts try to call any team, committee, or department a professional learning community when it is not. When schools say they use this model and see no improvements, frustration sets in and schools start looking for the next promising initiative. Collaborative plan time among teachers is deeply embedded into all aspects of planning for standards-based practices in the professional learning community model, even when the model appears to be working (Guskey, 2005). The practices of letting students fail, teachers calling for a collaborative discussion on hall passes, and ending the collaboration process after standards are established, then assuming that teachers implement them, are not what DuFour (2004) calls professional learning communities. Although many schools will use the term and speak as though they have all the elements of the professional learning community model

in place, it takes probing into the culture of the school to determine if the model is truly working as it should.

Thus far, this chapter has focused on high-quality professional development for all teachers. It is important to note that science teachers have specific needs. Because new middle school science teachers are the focus of my data collection, the following section is devoted to professional development that targets this group.

Professional Development for New Middle School Science Teachers

The professional development of science teachers is particularly valuable in modern education, in which there is an ever-increasing development of learner-centered instruction. In addition to this focus on what learners know, there is also more testing of students at all levels and a push toward better alignment of the different components of education. Professional development for science teachers must target the subject matter content as well as the means by which to teach such an inquiry-based subject.

Middle school science teachers must balance knowledge of content-specific standards, curriculum, teaching models, and instructional materials. Because of the subject's hands-on approach and inquiry teaching method, teachers must be well versed both in content knowledge and how students interact and learn complex concepts. Therefore, providing professional development to science teachers is a never-ending process, especially when technology and new discoveries advance our knowledge and understanding of the subject each year.

In order to ensure that science teachers are both prepared and knowledgeable, reform in the area of professional development continues to evolve. This includes offerings for both new and current teachers. New science teachers need to be adequately

trained to educate today's children. Similarly, because it is expected that currently-practicing teachers keep up with current reforms, they also need to be appropriately trained through ongoing professional development (Hewson, 2007). The following information should help the reader understand the needs of today's science teachers and how schools can adequately provide professional development to ensure each student has a highly qualified teacher in the classroom.

Teaching science is a lifelong process. One of the most important pedagogical discussions while training science teachers is the question of *What does it mean to actually learn a science concept?* To address this, Gallagher (2000) promotes teaching for understanding by application of knowledge. This means the student can apply the science concept and understand the idea rather than memorize mass information about scientific ideas. Professional development should promote teaching concepts and applications over teacher lead lessons that only require basic comprehension of facts. Sparks (1997) feels that the science curriculum in the United States is:

A splintered curriculum...with far too many topics...Our teachers typically have no coherent teaching/learning model which creates and pursues a storyline for a lesson, a unit, a course of study...Furthermore, demands from national, state, and district levels are such that teachers have no choice but to try to do everything and feel less than successful with anything. (p. 23)

Professional development in science has many dimensions (Hewson, 2007). Certainly, it is about teachers themselves, including their teaching activities involving curriculum, instruction and assessment. It is also about students and their learning and about the educational system as a whole. Professional development in science is about

teachers being professionals with a knowledge base that is shared within a professional community. In addition, it involves teachers as adult learners as well as the scientific disciplines.

While the number of studies that pertain to professional development of science teachers is relatively limited, there are some studies that have provided some valuable information. Kennedy's (1999) review of professional development in science and mathematics concluded that the content of professional development (what to teach and how students learn it) was more important than its form and structure (its duration, and whether it was woven into teaching). However, Hewson's (2007) review did not support this. Rather, without continuing support during the critical phases of planning, implementing, and reflecting on instruction, science teachers are unlikely to make significant changes in their teaching.

Some might suggest that no progress happens professionally without a phase of personal and social development (Bell & Gilbert, 1996). Adult learning theories, particularly transformative learning (which will be discussed at length in a later section of this chapter) follows this thinking. Adults who feel empowered and respected can gain more from their professional development experiences. Adult learning is facilitated by taking others' points of view into account (Mezirow, 1997).

What do good professional developers do? This was addressed by the professional development team of the National Institute for Science Education in the United States (Loucks-Horsley, Hewson, Love, & Stiles, 1998). They highlighted the need for professional developers to be aware of the wide range of knowledge bases, of the context of their particular programs, and of any critical issues that arise as programs are designed.

Abell et al.'s (1996) theoretical framework of professional development for science educators speaks to how professional development trainers should approach teachers.

Through professional development, Abell et al. (1996) assert:

Teachers build their systems of beliefs, values, assumptions, and practices.

Science teacher educators must appreciate the developmental aspects of teacher thinking when planning instruction. The job becomes one of facilitating teachers to uncover their implicit theories of teaching and learning, finding ways to challenge these theories, and providing opportunities for teachers to apply their theories to problems of practice. (p. 137)

Asking science teachers to challenge and reflect upon their own theories and practices should encourage a paradigm shift away from authoritative instructional practices and toward teaching constructively.

Ultimately, the mark of good teaching really comes down to what students learn and know. Fishman, Marx, Best, and Tal (2003) explored the link between professional development programs and science teachers' practice. They stressed the importance of connections between a professional development program, teacher practice, and student learning.

High-Quality Professional Development Models in Science

There are a variety of models and strategies that can be implemented in changing practices in the classroom. One model that professional development planners can use to promote deeper understanding of science concepts is discovery learning. Jerome Bruner's concept of discovery learning is described as a form of learning cycle that follows three chronological strategies: exploration, concept introduction, and application (as cited in

Brown & Abell, 2007). Exploration and hands-on manipulation must be used before direct teaching. When students can play and experience hands-on manipulatives, they have the chance to gain experience and form a context to which the teacher can then introduce facts and vocabulary. The final step is to take that new formulated knowledge and apply it to new situations. This is a higher level process that can only happen when the student has truly made sense and meaning from the first two steps of the learning cycle.

Variations of the learning cycle, such as the 5-E model (Engage, Explore, Explain, Elaborate, and Evaluate), support students playing and investigating before diving into terms and concept explanation (Bybee, 1997). Brown and Abell (2007) found that students needed three to four experiences with new science ideas before they were able to commit these ideas to long-term memory. While training teachers to think about the learning cycle, it is important to remind them that students may need hands-on activities several times in the unit and particularly when introducing new concepts. A teacher's expectations for student learning will likely fall short with one-shot lessons that begin with reading from the textbook and include minimal or no student engagement.

The National Academy of Sciences (1996) encourages teachers to adopt a constructivist view of student learning by allowing students to examine questions of their own interest and to learn concepts through hands-on activities and discovery. For many teachers, this means professional development must model strategies consistent with allowing teachers to experience science first hand (Sparks, 1997; Freeman et al., 2004). For example, frontier science would allow a physics teacher to work with a collaborating scientist in the field to help the teacher experience the latest in nuclear physics or

biogenetics. This type of professional development opportunity can also be done with technology via telecommunications. A scientist could participate in class discussions and examine student work. Allowing opportunities for teachers to participate in constructivist learning themselves can help them understand how those ideas might be incorporated into their daily science lessons for students.

What other strategies should be the focus for science teachers' professional development? Assuming that core subject knowledge is addressed as a prerequisite for certification, the focus should be on meaningful application. Teachers who have their students write during science class can promote understanding that makes connections with prior knowledge and application of concepts (Abell, 2006). Writing can be in the form of recording, reflecting, constructing responses to open ended questions, summarizing, or organizing thoughts. Writing can be beneficial in helping reformulate and extend students' knowledge, promote reasoning, and is one way to review ideas. One difficulty with having students write everyday is determining how best to respond and analyze the writing. Abell (2006) worries that teachers sometimes see a key vocabulary word or target phrase and believe students have a clear understanding of the day's concept. Teachers need to push for clarity in explanation and conceptual understanding when asking students to write.

Another area of professional development for science teachers should be assessment of student learning. Formative assessments can do much more to provide feedback to students than summative assessments. "Effective instruction and assessment are indivisible...when teachers require students to write, draw, and/or speak in response to questions and problem situations. Predicting activities, end-of-class reflective writing,

concept maps, scientists meetings, and science notebook tasks provide contexts for students to try out their developing understanding and receive feedback from the teacher” (Lee & Abell, 2007, p. 66). Summative assessments are more for grading purposes at the end of a unit for the sake of final evaluation and do little to help the teacher change or improve instruction within a unit. Teachers can use a variety of formative assessments on a daily basis to subsequently plan lessons for the following day. Science teachers can also use open-ended questions with adequate wait time for responses when leading group discussions (Lee & Abell, 2007). These types of techniques must be explained and embedded in professional development training if classroom level practices are to change.

At the middle school level, teachers may argue that having students construct their own knowledge with hands-on experiments takes too much time and may not cover all the basic vocabulary and facts that students need to understand for state tests. Professional development trainers should, therefore, instruct science teachers who primarily do direct teaching of facts to at least incorporate science “talk” and not just give students the answers (Gagnon & Abell, 2007). Direct instruction is usually a teacher question followed by a student answer that promotes an authoritative approach and keeps the students guessing as to what they believe the teacher wants to hear as the right answer. On the other hand, true science dialogue is when teachers ask a question to which they do not presume to already know the correct answer (Lemke, 1990). This type of questioning or “talk” allows students to compare ideas, revise explanations, and become engaged in developing an answer. This type of questioning should be modeled for teachers because it also may involve a preliminary discussion of group norms and rules,

teams of students sharing before the larger group discussion, and allowing students adequate time to independently reflect on the question. Teachers who buy into this type of pedagogy should find students monitoring and questioning their own thinking, which is very different than listening to the correct answer from the teacher.

The Role of National Science Education Standards in Professional Development

To accompany the NSDC standards that were previously mentioned, the National Academy of Sciences (1996) developed National Science Education Standards (NSES), which address the professional development of science teachers. The NSES place a greater emphasis on teaching science through inquiry-based techniques than through the direct teaching of facts. Because of this change in emphasis, these standards have had a profound effect on the way schools and teachers view and provide science education during the past decade. Chapter three of the NSES document notes that teachers of science should, under its teaching standards, do the following: (a) plan an inquiry-based science program for their students; (b) guide and facilitate learning; (c) engage in ongoing assessment of their teaching and of student learning; (d) design and manage learning environments that provide students with the time, space, and resources needed for learning science; (e) develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning; and (f) actively participate in the ongoing planning and development of the school science program (National Academy of Sciences, 2007).

One reason for providing schools with national science standards is to help facilitate the type of change that will increase student achievement. The NSES outline “what students need to know, understand, and be able to do to be scientifically literate at

different grade levels” (Wheeler, 2006, p. 169). The NSES call for instruction that allows students to take control of their own learning and focus on real life issues that have meaning for them through student-centered, inquiry-based learning experiences” (Johnson, 2006, p. 150). This asks teachers to allow for more student control in planning their own investigations, gathering data, and communicating findings in the form of scientific arguments. For this type of instruction to take place, many teachers need training. More critically, many teachers require a paradigm shift to more student lead and interdisciplinary activities.

NSES standards for interdisciplinary instruction help strengthen students’ science learning. Research suggests that learning big ideas and frameworks is more powerful than learning individual or fragmented ideas. According to Rogers & Abel (2007), interdisciplinary instruction encourages connections among disciplines, background knowledge, and builds networks of associations to help apply science concepts. Interdisciplinary instruction can include providing local issues to discuss, providing historical backgrounds for science concepts, and adding mathematical and writing components into the study of science concepts.

Universal standards and benchmarks are one of the few initiatives with enough power and influence to help unify and equal the playing field from state to state. Currently, the U.S. has about 15,000 school districts that make their own decisions about science curriculum and how to teach it. Having everyone follow the same set of standards could help define the limits of acceptable content, fight inequalities, help with textbook and instructional selections, and provide assessments that find out what students know and can do. Invoking change in schools can take decades, so finding research that shows

a link between student scores and national science standards continues to be an obstacle when new political leaders change so frequently (Bybee, 2006). It may be time for the 1996 standards to be revised by reducing the amount of content and clarifying the fundamental concepts of what students should know and be able to do.

It should be noted that an obstacle for interpreting and implementing the national science standards in the middle school grades is the issue of age-appropriate competencies based on intellectual development of students. For example, U.S. national science education standards have been found to overestimate the competences of elementary, middle, and high school students when examining a sample of national scores from the 1995 Third International Mathematics and Science Study (TIMSS) in the area of matter concepts. Based on the average of national scores, seventh and eighth graders were found to be at the beginning level of differentiating chemical properties and were not ready for the particle model of chemical change (Liu, 2006). This means science coordinators and curriculum planners must recognize what students are truly ready to tackle at each grade level, and then provide differentiated curriculum and instruction at each grade level. Therefore, science teachers need to be trained to appropriately differentiate their instruction.

Special Considerations Regarding Effective Science Professional Development

Even with effective professional development that follows the recommendations of the National Science Education Standards, there are barriers that can keep teachers from reaching their goals. Technical issues, political obstacles, and cultural barriers may keep teachers from implementing truly inquiry-based learning (Johnson, 2006).

Technical concerns include content knowledge, pedagogical knowledge, and the ability to teach constructively and implement reform. This includes a teacher's instructional skills, classroom management style, assessment issues, time for planning, and inadequate in-service training. Political barriers include lack of school or district level leadership and support. Cultural barriers involve teachers' existing beliefs and values regarding teaching. There can be such a demand on beginning teachers to teach the facts and there are many "teachers who feel obligated to transmit content knowledge [simply] in order to prepare students for the next grade" (Johnson, 2006, p. 153). Cultural barriers seem the most difficult to change because it requires a change in the core philosophy of how to teach and the purpose of teaching.

Teachers across schools with varying experience have reported barriers in all three dimensions. It was found that any lack of administrator buy-in, time, or resources, or an inadequate addressing of existing teacher beliefs, held back teachers and schools from becoming inquiry-based in their science instruction. Johnson (2006) found the following:

Participants in this study confirmed a prevalent belief of teachers today that the state science assessments are in conflict with the philosophy contained in the NSES, including the use of inquiry and investigative science, because many teachers do not realize that most test instruments today are written at the comprehension, application, and analysis levels, not at knowledge levels. (p. 160)

Schools that plan to train science teachers to use inquiry-based constructivist lessons must address these barriers and not simply assume that discussing research-based techniques ensures implementation. Examining barriers can aid planning ongoing

professional development that will allow for strong leadership, appropriate resources, and reflection time to develop new ideas and philosophies that are required to actually change a teacher's belief system.

The nature of research on teacher professional development in science is complicated and difficult because it is inherently complex, consisting of numerous interrelated components (Hewson, 2007). Very few studies have been able to assess a combination of teacher needs, program structure and design, and affects on student achievement. Linking all of these together seems crucial, but difficult to do.

One might ask why the culture of science education and learning has remained a problematic issue when researchers over the past century seem to agree that the constructivist inquiry approach to science has advantages for deeper understanding. One continued problem with science teachers is a lack of core knowledge in making connections to science concepts. There is the issue of a lack of real world examples that help make connections to previous student knowledge.

Another obstacle to constructivist approaches to science education is that "the examinations and tests students take do little to foster development of understanding. Instead they reinforce memorization and do not stimulate students to seek understanding" (Gallagher, 2000, p. 311). Gallagher also noted that high achieving students sometimes resist teachers who try to make connections to the real world because in previous science courses, they have learned that just learning the facts is the key to success. Furthermore, science teachers must be taught to use embedded formative assessment that helps students understand how the concept is related to previous and future content. So it seems that decade after decade, many teachers have lacked basic knowledge of the subject and

the ability to explain concepts through real world examples. Professional development must intervene if this cycle is to be broken.

Therefore, it is up to professional development committees and administrators to examine the issues discussed in this research review when planning to train new science teachers. According to Johnson (2006):

The problem with reform-based interventions is that they have rarely resulted in changes in classroom practice. This is due to the difficult task of designing professional development experiences focused on changes in fundamental and complex beliefs about what it means to teach, learn and the goals for science instruction. (p. 161)

The pathway to increasing student achievement through professional development is very complex, but being knowledgeable about barriers teachers face and using research-based pedagogy should increase the likelihood of positive reform.

Assuming a school has the proper culture to support collaboration and shared leadership, and assuming that trainings are addressing the subject-specific needs, professional development facilitators also need to recognize the importance of adult learning research. Only by recognizing the way adults learn can we effectively teach them new information.

Adult Learning Theories

When presenting new information to teachers, it is possible for public school districts to make informed decisions based on adult learning theories. In addition to considering the school culture, national standards, and models for implementation,

officials and administrators should also consider who comprises the “student body” in this situation: *adult* teachers. Knowledge of adults’ learning styles is of the essence.

“Informal and incidental learning is at the heart of adult education because of its learner-centered focus and the lessons that can be learned from life experience” (Marsick & Watkins, 2001, p. 25). Marsick and Watkins (1990) explain:

Formal learning is typically institutionally sponsored, classroom-based, and highly structured. Informal learning...is not typically classroom based or highly structured, and control of learning rests primarily in the hands of the learner.

Incidental learning is defined as a byproduct of some other activity, such as task accomplishment, interpersonal interaction, sensing the organizational culture, trial-and-error experimentation...and almost always takes place although people are not always conscious of it. (p.12)

Examples of informal learning include self-directed learning, networking, coaching, mentoring, and performance planning (Marsick & Watkins, 2001).

Organizations can provide different incentives for learning, both informal and incidental. This includes tuition reimbursement, and resources, such as a library of reference material, subscriptions to professional journals, video courses, or computer-based courses. In particular, school organizations can encourage peers to work and learn collaboratively (Marsick & Watkins, 1999; Merriam, 2001; Watkins & Marsick, 1993, 1996). Mezirow (1997) says that educators of adults can focus on activities such as learning contracts, group projects, role play, case study, and simulations. These types of activities encourage critical reflection and discourse.

Professional development planners should help instructors to shift from teacher-centered professional development to learner-centered professional development (Wells, 2007). School districts that plan on providing professional development for their adult teachers should recognize and consider how adults learn. There is copious research explaining various learning theories related to children as well as innumerable descriptions of learning style differences in students. The expansive information on learning theory as it relates to children in the classroom can make it easy to overlook the fact that adults may learn differently from children. However, there are distinct differences in the way children and adults learn, specifically self-concept, experience, readiness to learn, orientation to learning, and motivation (Knowles, 1984). These differences will be clarified in the following sections. Some child and adult learning theories will be defined and explained.

How Child Learning Theories Influence the Pedagogy of Professional Development

This section provides the reader with a knowledge base for understanding how student learning differs from adult learning. Furthermore, professional planners and teachers can both benefit from using the following section as a lens through which to view professional development activities as the ultimate way to improve our teaching of child learners. Since my study involves data collected from middle school teachers, child learning theories will be briefly described as they relate to the middle school student.

Cognitive and affective theories can be used to understand the middle school student. The cognitive realm deals with how students learn and the affective realm deals with the social relationships and emotions of students. There are two main types of cognitive learning theories: behaviorist and constructivist. Behaviorists, such as Pavlov,

Thorndike, and Skinner, believe that learning occurs when the appropriate outside stimulus is provided to students (Bucher & Manning, 2001). This means that students who are given reinforcement will continue similar behavior in the future. Constructivists, such as Dewey, Vygotsky, and Piaget, believe that learning occurs through social experiences when interacting with the environment (Brooks, Fusco, & Grennon, 2002). This means that students go through stages of maturity if allowed to experiment with hands-on, real world curriculum and group work. Teachers need not choose between the theories, but rather, they should consider both when planning for classroom management.

Matching the curriculum to student cognitive levels can be done (Bissell & Lemons, 2006) using Bloom's Taxonomy, which delineates six categories of learning: basic knowledge, secondary comprehension, application, analysis, synthesis, and evaluation. The first two categories do not require critical-thinking skills, but the last four all require the higher-order thinking that characterizes critical thought. Checkley (1997) reminds teachers that not all students are good test takers and the standard IQ test for intelligence is out dated. Teachers and administrators can also consider Howard Gardner's Seven Intelligences when matching student cognitive levels to the curriculum. Students can excel in areas other than language and mathematics, such as music, spatial, interpersonal, intrapersonal, and bodily kinesthetic.

One of the most compelling theories of cognitive levels for middle school students is Piaget's notion that not all students are ready to problem solve at high levels. Piaget's stage of formal operations suggests that students under the age of 11 do not function in formal thought (as cited in Brooks, Fusco, & Grennon, 2002). Furthermore, unlike Piaget's 1958 assertion that all children reach formal thought, it is estimated that

less than 50% of students older than 11 consistently function in formal thought. Middle school students are in a transitional period, and it is common for some students to use formal thought on one assignment only to revert back to lower stages of cognition for others. This research has implications when teachers plan curriculum and classroom management plans.

Two other learning theories worth considering regarding middle school students are those of Erikson and Kohlberg. Erikson is famous for his notion of identity cycles and Kohlberg developed stages of moral development similar to Piaget's work. Boeree (2006) summarized Erikson's eight stages of identity by saying that middle school students transition between stages four and five. Stage four (ages 6-12) is called latency, in which children who are not allowed success by teachers, parents, or peers can develop inferiority. Children who feel inferior believe their success is related to who they are and not how hard you work, and think that it is ok not to try if at first you don't succeed. Stage five (ages 13- 20) is called adolescence, where students try to achieve ego identity and avoid role confusion. Students in this stage ask, "Who am I?" They look for role models and groups that match their identity, even if the group is destructive.

Lawrence Kohlberg, who primarily worked with male subjects, offered the idea of moral stages, and Carol Gilligan focused on moral development that brought in the female perspective (Wren, 1997). In stage one, children do not question right and wrong. In stage two, the child begins to see different viewpoints. In stage three, the child wishes to be a good person, whereas stage four children think about what is best for society. In stages five and six, people are more concerned about what makes a good society and the democratic process of justice. Educators can stimulate moral development in students not

by strict authority, but by engaging students to think and discuss viewpoints higher than their current stage (Crain, 1985). Research has shown that male and female students may prefer different learning styles (Wren, 1997). Male students often test for truth and engage in deductive reasoning in an autonomous style. Female students may engage in reasoning that unites self-reflection and caring feelings into decision-making. In other words, boys may prefer to work on individual projects while girls may prefer to work in groups. Middle school teachers should use a variety of both types of lessons.

This discussion of child learning theories seems like an appropriate place to mention the Positive Learning Environment approach to middle school instruction (Brophy, 1998; Chemlynski, 1996; Hester, Gable, & Manning, 2003), which addresses the value of positive teacher-student interactions. Adolescents 10-15 years old need a positive atmosphere that values gender, culture, engages students, builds self-esteem, and clear expectations. When teachers use coercion, manipulation, and control, they can trigger student anger, defiance, and revenge. Building a positive learning environment requires acknowledging the students' strengths, modeling positive behaviors, building trust, listening, and responding positively to students verbally and nonverbally (Mitchem, 2005). Simple rewards such as smiling, praising, and complementing are quick and easy ways teachers can promote and model a positive atmosphere.

As this review of child learning theories shows, there are a wide variety of theories related to what is important for a child to successfully grow and develop as a person. In practice, most educators would likely agree that there is no one correct or incorrect philosophy. Rather, a consideration of multiple theories is necessary to best view a child and his or her needs.

How Adult Learning Theories Influence the Delivery of Professional Development

As previously mentioned, there is extensive research in the area of child learning and learning theory. Similarly, research in the area of adult learning theory is expansive and diverse. It is imperative that school districts consider the framework of adult learning theories when planning for effective professional development opportunities.

The notion of adult learning can be traced back to ancient Greek and Romans, and there is a rich European tradition of it in the 19th and 20th centuries (Salvicevic, 1999). While pedagogy is the art and science of teaching, andragogy is “the art and science of helping adults learn” (Knowles, 1980, p. 42). Adult learners should be responsible for taking control of their learning by choosing topics that interest them. Learning should be for the sake of learning and not just because of extrinsic factors. “Andragogy and self-directed learning were the first two attempts by adult educators to define adult education as a unique field of practice, one that could be differentiated from learning in general and childhood education in particular” (Merriam, 2001, p. 11).

Teachers of adult learners who apply the andragogy theory must help adults learn for themselves by providing approaches that promote voluntary participation in planning for all areas of a course. This includes the objectives to be learned, activities, assignments, and even a voice in how the adult learner will be assessed (Rachal, 2002). Professional development planners who buy into the basic idea of Knowles’s definition of adult learning will help teachers seek out their own interests when choosing professional development activities.

Incorporating Adult Learning Theories When Providing Professional Development

Four adult learning theories that have implications for professional development of teachers are age theory, stage theory, cognitive development theory, and functional theory (Trotter, 2006). In order to plan for professional development of teachers, it is useful to understand that adults have different stages of development, as well as different perceptions based on experience and age. Adult learning involves understanding brain function and how memory is stored and retrieved in order to choose a professional development plan that corresponds to how adults learn new information (Hill, 2001).

Age theorists, such as Sheehy and Levinson, believe that adults become more reflective in their lives and careers as they get older. Older adults are able to make sense of the world despite its growing complexities and diversities. Under these theories, 40- and 50-year-old teachers can reflect upon and evaluate life and learning more thoroughly than younger teachers (Trotter, 2006). Professional development should consider building time into the schedule to help teachers reflect and make meaning of the act of teaching and the implications of the professional development activity as it relates to one's own practices.

Stage theorists, such as Piaget and Loevinger, believe that adults pass in and out of stages. Early stages focus on orientations of authority, peer approval, and selfishness whereas older teachers already have an identity of the self and are ready to build bridges and make connections with others (Trotter, 2006). Older adult teachers will find themselves in stages that focus less on conforming and more on evaluating and judging the value of activities. Collaboration and team building with co-workers may be much

more useful tools for adults working in later stages of development, whereas younger people may have difficulty seeing multiple points of view.

Cognitive developmental theorists, such as Hunt and Perry (whose theory is also stage theory), break down cognitive development into stages. Cognitive development refers to a person's level or degree of abstract thinking. Adults tend to move from concrete to abstract thinking. Adult teachers will work in stages that make them increasingly aware of personal feelings, reliance on internal rather than external standards, and the ability to work with others who have multiple viewpoints (Trotter, 2006). By considering the stages of cognitive development, facilitators of professional development can better understand why a veteran teacher may be more likely to have commitment and self-affirmation and less need for additional carrots dangled in front of him than a new teacher who is working in a lower stage and may need additional motivators. Understanding that adult teachers work in different stages can greatly impact how schools group teachers and plan professional development activities.

Functional theorists, such as Lindeman, Gibb, Knox, and Smith, view professional experience as the adult learner's textbook. The learner should be the primary focus of adult education. Adult learners will want to choose educational topics that directly apply in their own classrooms. Adult learning should be voluntary, lifelong, personal, involve change, and relevant to the adults' development stage and life role (Trotter, 2006). Teachers must find the professional development activities relevant to their current or future assignment if the training is to become embedded in the repertoire of new skills or knowledge.

Adult learning theory: Constructivism and experiential learning. Constructivism and experiential learning theories agree that the learner must link previous knowledge and personal experience to new information in order to make connections and understand how the new information is relevant and important. K. Taylor (2006) asserts that if the learner cannot make this link to prior knowledge, many adults will simply memorize the new information for short recall only to lose the information down the road; thus, no true learning occurred. Professional development instructors must prime the learners' synapses by making them connect with their own life experiences. Of utmost importance is helping teachers get actively engaged in learning by personalizing the new information into a context that the teachers will later be able to recall in their own classrooms.

Adult learning theory: Transformational learning. Transformational learning is reflecting on one's own values, beliefs, and assumptions and requires discourse with others to establish new, meaningful perspectives. Mezirow (1981) moved "beyond andragogy" and proposed a theory of transformative learning that can explain how adult learners make sense of their experiences. E. W. Taylor (2006) explained that transformational learning challenges one's beliefs about how things should be and how we should view society by questioning one's current lens or framework for viewing the world. It can occur gradually or from a sudden, powerful experience, and changes the way people see themselves and their world (Merriam, 2001).

Mezirow (1997) researched transformational learning and developed the following definition:

Transformative learning (Mezirow, 1991, 1995, 1996; Cranton, 1994, 1996) is the process of effecting change in a frame of reference. Adults have acquired a

coherent body of experience—associations, concepts, values, feelings, conditioned responses—frames of reference that define their life world. Frames of reference are the structures of assumptions through which we understand our experience. (p. 5)

These frames of reference have two dimensions: habits of mind and points of view. Habits of mind are a set of predisposition codes that are cultural, social, political, economical, and educational, and help shape our point of view. A point of view is subject to change as adults reflect on the content or process by which we solve problems modify assumptions.

Transformational learning theory has been conceptualized in a four lens approach. The first lens draws on Freire's (2000) notions of emancipatory education. Freire's work with the poor helped him realize that passive listening and acceptance of facts kept his students disenfranchised. Freire (2000) encouraged students to discuss issues and how to overcome them. Through this "conscientization" (p. 17), Freire's learners came to see the world and their place in it differently. Empowered in their new perspective, they could act to transform their world (Baumgartner, 2001).

The second lens of transformational learning is the cognitive-rational approach advanced by Mezirow (1991; 2000). Knowledge is not "out there" to be discovered but is created from interpretations and reinterpretations in light of new experiences (Mezirow, 1996). The process of transforming perspective begins with a disorienting dilemma followed by critical reflection and reevaluation of the assumptions they have made about themselves and their world. People then engage in reflective discourse, and finally action on the new perspective is taken (Baumgartner, 2001).

The third lens is most prominently articulated in Daloz's (1986; 1999) writings. The transformational learning process is intuitive, holistic, and contextually based. It is a procedure in which a mentor guides students in a learning journey affected by the student's social environment, family dynamics, and social class. This lens humanizes the transformational learning process (Baumgartner, 2001).

The fourth lens of transformational learning is the link between spirituality and learning. Dirkx (1998) speaks of the role of imagination in facilitating learning through the soul and relies on words to communicate ideas, feelings and images, while Healy (2000) believes transformational learning can occur during meditation (Baumgartner, 2001).

No discussion of transformational learning would be complete without mention of King and Kitchener's (1994) critical reflection of assumptions (CRA). Their five sets of learning assumptions present considerable empirical evidence for the development of reflective judgment from childhood to adulthood. A brief explanation of the stages follows.

In Stage 1, there is a single concrete category of knowing. Certain knowledge is gained by direct personal observation and needs no justification. In Stage 2, there are two concrete categories of knowledge. A person can know with certainty through direct observation or indirectly through an authority. In Stage 3, several concrete categories of knowledge are interrelated. Knowledge is assumed to be either absolutely certain or temporarily uncertain. Justification is based on authorities' views or on what "feels right." Stage 4 is when knowledge is understood as a single abstraction. Knowledge is certain and knowledge claims are assumed to be idiosyncratic to the individual. Stage 5

includes two or more abstract concepts of knowledge that can be related. Knowledge is seen as contextual and subjective. Beliefs are justified by using the rules of inquiry for the appropriate contexts. In Stage 6, abstract concepts of knowledge can be related. Knowledge is actively constructed by comparing evidence and opinion on different sides of an issue; solutions are evaluated by personally endorsed criteria. Stage 7 involves abstract concepts of knowledge that are understood as a system. The principle is that knowledge is the outcome of the process of reasonable inquiry for constructing a well-informed understanding.

Adults who reach the sixth and seventh stages represent reflective judgment. This concept implies arriving at agreement on meaning through discourse by giving and assessing reasons, by examining evidence and by seeking to validate beliefs consensually. This view is consistent with the theory of transformation (Mezirow, 1998).

Ideal conditions for transformational learning include the need for “a safe, open, and trusting environment” (Taylor, 2000, p. 154) that allows for participation, collaboration, exploration, critical reflection, and feedback. Professional development activities can help stimulate transformational learning through self-reflective activities, group discussions, and journaling. It seems that professional development needs to be carefully planned over a series of sessions in a structured setting where people adhere to agreed-upon guidelines for safety and confidentiality.

There are some ideas for adult learning instructors that stem from transformational learning. Instructors may want to first discuss assumptions of a group of teachers before diving into teacher training to help stimulate multiple perspectives and transformational learning (Taylor, 2000). Reflection time and personal work time during

and after professional development activities is often difficult to incorporate into a busy school year, but is truly necessary for adult learners to get the most out of a training workshop. Instructors should consider relinquishing some of their authority or “position power” in the classroom (Cranton, 1994). Cranton also recommends recognizing the learners’ learning styles so they can question their assumptions. Fostering group ownership and placing teachers at the center of their own learning is a critical step in transformational learning (Baumgartner, 2001).

Adult learners need to be critically reflective of their underlying assumptions as well as critically examine alternative points of view in discourse with others. Mezirow (1997) believes:

There are four processes of learning...one process is to elaborate an existing point of view...establish new points of view...transform our point of view...finally, we may transform our ethnocentric habit of mind by becoming aware and critically reflective of our generalized bias in the way we view groups other than our own...We do not make transformative changes in the way we learn as long as what we learn fits comfortably in our existing frames of reference. (p. 9)

For professional development of adult teachers, “educators must help learners become aware and critical of their own and others’ assumptions. Learners need practice in recognizing frames of reference and using their imaginations to redefine problems from a different perspective. Finally, learners need to be assisted to participate effectively in discourse” (Mezirow, 1997, p. 9). Creating an atmosphere for effective discourse requires educators to allow learners to have full information, have no coercion, have equal opportunity in discourse, have time to reflect on assumptions, and remain open to

other perspectives. Simply presenting new information will not automatically result in adult learning. Rather, learning occurs best through “...critically reflective thought, imaginative problem posing, and discourse that is learner-centered, participator, and interactive, and it involves group deliberation and group problem solving” (Mezirow, 1997, p. 11).

Before one can claim that transformational learning has occurred, there must be evidence of change. Cranton and King (2003) explained:

Effective professional development brings our habits of mind about teaching into consciousness and allows us to examine critically what we believe and value in our work as educators. The goal is to open up alternatives, introduce new ways of thinking about teaching—a goal that is potentially transformative. (p. 34)

There are several strategies that professional development planners can consider when planning activities that foster transformative learning in adults. Cranton and King (2003) suggest the use of action plans, reflective activities, case studies, curriculum development, and critical theory discussions. Brown (2005) suggests the use of educational plunges, critical reflection, diversity panels, rational discourse, and cross-cultural interviews. Educational plunges are when learners should actually experience a different culture or situation that challenges their comfort level. Critical reflection can be done with journals in which one begins to question one’s own perspective and seek out alternative viewpoints. Diversity panels ask learners to research a different culture or perspective and then present or teach the history of that perspective to others. Rational discourse is a narrative form of group discussions that asks students to open up to new perspectives and seeks to understand why someone else would have different opinions.

Finally, cross-cultural interviews are a one-on-one encounter with people or cultures that are different from the learner's.

Several types of learning activities can increase transformational learning. The top four activities in King's (2004) study were: discussion, journals, reflection, and readings. It was also found that negative feedback from other classmates and co-workers "shut you down" when discussing new and different ways of thinking that challenges the norms of a group. Another barrier was internal, in that students seemed to question their own beliefs and were scared and afraid to change or do anything with the new perspective they had gained during class.

Do all adults have the capacity and developmental level to learn as Mezirow (1997) described in transformational learning? Is a rather high level of cognition a prerequisite for transformational learning? It seems so, and there is a variety of research that delves into specific ages and stages of development for this. This research suggests that some adult teachers may not be ready to learn transformationally. Merriam (2004) notes that the level of cognition required for critical reflection and discourse that challenges one's own and others' assumptions would be at the fourth stage of Piaget's (1972) formal operations and the top two categories of King and Kitchener's (1994) stages of development. Furthermore, Merriam (2004) noted that studies based on Piaget revealed about half of adults think at the formal thought level, while other studies found education level and age to be correlated with being able to think at high developmental levels. The transformations likely to produce developmentally-advanced meaning perspectives and critical inquiry are found in some educated adults as they mature into their thirties and beyond (Kitchener & King, 1990; Mezirow, 1991).

So, one might think of development in adulthood as the movement through phases of meaning becoming clarified through stages of cognitive development. Mezirow (2004) shared the following about transformations:

There is also recognition that this occurs only in adulthood but not in all or even most adults. Capacity, an unrealized potential for transformative learning, is one thing. Another is to help these adults acquire the insight, ability and disposition to realize this potential in their lives. This is the role of adult education. (p. 69)

The Role of Stress and Emotions in Adult Learning Theory

While most researchers have focused only on the cognitive and intellectual dimensions of teaching and learning, some believe the affective dimension of learning dealing with emotions has a major role for understanding how adults learn. Dirkx (2006) states:

Emotions are deeply involved in the process of transformative learning in at least two fundamental ways. First, the process of critical reflection, as described by Mezirow as central to transformative learning, essentially calls into questions and invites exploration of alternative ways of being-in-the-world. As learners make explicit and reflect on their assumptions, the process may be accompanied by various emotions, such as guilt, fear, shame, a sense of loss, or general anxiety...Second, a person's unconscious emotional responses to various aspects of the learning experience can serve as an expression of the journey of individuation, an area of one's psychic life seeking voice within a particular context. (p. 20)

Traditional Freudian adult researchers believe emotions are something that learners need to resolve. They perceive emotions as “hang-ups” or disrupting the learning process and our capacity to adapt to the demands of our reality. Dirkx (2006) maintains that:

Jungian scholars, however, tend to understand many of the powerful emotional issues that arise within the learning environment, at least in part, as intrinsic aspects of being human...Their expression is bound up with what Jung (1969) refers to as individuation, a process by which we come to recognize and develop an awareness of who we are and how we relate to others. (p. 18)

Professional development instructors cannot be expected to be counselors, but ignoring the connection between stress and emotions when providing adults with new information can significantly impact the amount of information that is retained (Cozolino & Sprokay, 2006; K. Taylor, 2006). Maintaining control over stress and emotions can enhance or retard an adult’s capacity to learn. Some sort of positive emotion is a requirement for leaning to occur. For example, an “Aha!” moment, a feeling that the content is personally relevant, and a positive relationship with the instructor can help embed long-term memory.

The teacher-learner relationship is one of trust and caring, and it is vital to developing the appropriate conditions for a transformational learning experience. So, a threatening emotion or fear of being called on by the instructor when you don’t know the answer can pump hormones into the body and make the brain less available for learning. Learners who see the instructor as an authority figure may not be able or willing to question their teacher’s values (Cranton, 1994; Mezirow, 1991). It is difficult to achieve

transformational learning in this setting (Baumgartner, 2001). Instructors of professional development activities should ponder less stressful ways to discuss and assess teacher learning within group situations to best enhance the learning atmosphere.

When dealing with adult learners, then, it is necessary to consider the way they learn as well as the factors, such as stress and emotions, which affect their learning. Trying to arrange professional development in a way that is considered high-quality can be challenging for planners. But the resulting professional development offerings can be dynamic and effective for teachers and students.

Summary

In summary, this chapter points out the need to base professional development around research-based strategies, standards, teacher needs, and collaboration. Creating learning communities, providing induction programs, using research on adult and child learning theories, conducting needs assessments, and following the National Staff Development Council guidelines have all been shown to have relevance when training new teachers. When training science teachers, it is also important to consider the National Science Education Standards, as well as inquiry-based instruction. The goal is to incorporate all of these ideas into the ongoing professional development of science teachers.

Many school districts create professional development committees, both at the district and building levels. These committees tackle and discuss professional development issues on a yearly basis in hopes of retaining and developing high quality teachers for every classroom. One of the key strategies should be the effective communication of a program or school's vision to all participants in that system. The

organization, school district, or individual school should be responsive to the needs and ideas of its members. Only then can a new reform, program, or learning opportunity be truly valuable and useful to both teachers and students.

Ensuring that there are highly qualified teachers in every classroom begins with induction and professional development training of new teachers. The growth of professional development activities that are standards-based, ongoing, and that promote student achievement should be the ultimate goal. This goal takes careful planning and coordination of needs assessments, a collaborative environment, and assessment tools that foster reflection. When a school district helps improve its teachers through high-quality professional development, the students and community are the ultimate beneficiaries.

CHAPTER THREE: RESEARCH METHODOLOGY AND DESIGN

Introduction

In this chapter, I submit to the reader definitions of, and the rationale for, the research methodology. I will explain the logic of the study design and provide an account of decisions made during the research process.

Research Methodology

Qualitative research design methods were used to collect data and answer the study's research questions. According to Bogdan and Biklen (2007), a qualitative study is "an approach to social science research that emphasizes collecting descriptive data in natural settings, uses inductive thinking, and emphasizes understanding the subjects' point of view" (p. 274). "Qualitative research is an umbrella concept covering several forms of inquiry that help us understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible" (Merriam, 1998, p. 5). Thomas and Brubaker (2000) claim that qualitative research does not oversimplify complex causes or dehumanize evidence. Rather, it recognizes individual differences among people, environments, events, and organizations.

Qualitative research is beneficial because of its focus on meaning in context. Humans are most suited for analyzing and understanding the type of data collected in a qualitative research study. According to Merriam (1998), qualitative research has five basic characteristics: (a) an understanding of the participants' perspectives, not the researcher's; (b) the researcher is the primary instrument for data collection and analysis; (c) the research involves fieldwork; (d) it employs an inductive research strategy (that is,

this research builds concepts or theories, rather than tests existing theory); (e) the product is richly descriptive. Each of these characteristics applies to this qualitative study.

In this study, I use qualitative research methods to theorize about the data in ways that help understand new teacher perceptions on how and why teachers feel supported by the types of professional development content, delivery systems, and leadership they have experienced during their first few years teaching in Midwest School District. Specifically, the study systematically examines the formal and informal ways new teachers experience professional development and the perceived effectiveness of components of that professional development. I did not enter into this study trying to prove a hypothesis. Rather, I allowed common strands and themes to naturally emerge from initial interview data. Teacher and administrator interview data, observations, and document analysis gradually gave me a rich description of the new teacher experience. Analysis and interpretation of data were not handled as a separate stage in this study. Instead, the data informed and helped me improve the collection of the next piece of data.

Drawing from grounded theory methods, interpretations in this study are derived inductively from raw data, and there is continual interplay between data and emerging interpretations (Fraenkel & Wallen, 2003). In such qualitative research, inductive thinking involves letting the analysis emerge during data collection rather than structuring a study around a hypothesis or narrow questions. This type of study is organic and constantly evolving. For example, the responses of one interview participant helped to shape some of the follow-up questions for the next research participant. I was not locked into a rigid methodology that involved a specific survey or number crunching. The data in this study shaped my understanding of events as data were being collected.

This qualitative research study is characterized as a case study. A case study is “a detailed examination of one setting, or single subject, a single depository of documents, or a particular event” (Bogdan & Biklen, 2007, p. 271). In this study, I use a qualitative case study to examine one particular group of new teachers in a single school district. The primary source of data in this study is teacher interviews, which seek to understand one phase of their experiences with professional development. Specifically, the use of new teachers of one subject who are working for the same district seems to follow the criteria of a case study.

Thomas and Brubaker (2000) said that case studies are intended to reveal the individualistic attributes of a particular person or institution. Merriam (1998) explains that “a case study design is employed to gain an in-depth understanding of the situation and meaning for those involved” (p. 19). The case study is unique because it examines a single unit or bounded system such as programs, events, groups or one organization. This study can be called a case study because it examines one specific suburban school district over a limited amount of time. Furthermore, Merriam (1998) explained that to be considered a case study, the number of participants, object of study, and the end product must be identified. This dissertation investigates a fixed number of science teachers who work within one organization, all of whom have shared common experiences in the same content areas and district programs such as orientations, induction programs, mentoring programs, and new teacher support groups.

The general design of a case study can be characterized by a funnel (Bogdan & Biklen, 2007). The beginning of the study is the wide end of the funnel. The researcher searches for potential topics, sources of data, and feasibility of the study. Data collection

begins, plans may change and develop over time, and eventually, all of the work develops a focus, or narrow end of the funnel.

The constant comparative method of data collection and analysis, developed by Glaser and Strauss (1967), was used in this study. “The basic strategy of the method is to do just what its name implies--constantly compare” (Merriam, 1998). This method is largely an inductive process, or one where analysis emerges as data are collected. As interviews were completed, I constantly analyzed responses, considered how it did or did not relate to responses from other interviewees, and made adjustments to follow-up questions. Bogdan and Biklen (2007) cite that this research design is for “multi-data sources in which the formal analysis begins early in the study and is nearly completed by the end of data collection” (p.271).

The constant comparative method involves comparing one piece of data with another to establish areas of similarity and difference. Data are grouped together on a similar dimension, which then becomes a category. Merriam (1998) explains that “the development of categories, properties, and tentative hypotheses through the constant comparative method (Glaser & Straus, 1967) is a process whereby the data gradually evolve into a core of emerging theory” (p. 191). Analysis attempts to find patterns in the data. The categories become the findings of the study. Then “when categories and their properties are reduced and refined and then linked together by tentative hypotheses, the analysis is moving toward the development of a theory to explain the data’s meaning” (p.192). Additional information on the development of categories, or a coding system, is included later in this chapter in the data analysis and interpretation section.

The aforementioned research methods guided my qualitative study of new middle school science teachers' professional development. What follows is a recap of the research questions, as well as details regarding the specifics of selections made, procedures followed, and analysis performed during this study.

Research Questions

As mentioned in Chapter One, there were four research questions that guided this qualitative case study. They are:

1. What is the extent and content of professional development when training new middle school science teachers in a suburban school district?
2. To what extent do new middle school science teachers find district-sponsored, new teacher professional development to be effective?
3. How, and in what ways, do new teachers perceive that their training supports their teaching practices?
4. How can suburban school districts better prepare new middle school science teachers through induction programs (including mentoring) and professional development offerings?

Design of This Study

Site Selection

Midwest School District is a pseudonym used to describe the general location of the district selected for this research study. This district was chosen partly because its location was convenient for me as the researcher. This location helped ensure timely completion of data collection. Midwest is a large suburban district, which has been recognized at local and state levels for academic achievement. In addition, Midwest

School District has multiple middle school buildings, which offered me numerous potential interviewees from whom to gain information and perceptions of district professional development.

To maintain participants' confidentiality, pseudonyms are used and district statistical data are approximated, yet close enough to give the reader a snapshot of the study site. Midwest serves well over 10,000 students. Midwest includes multiple school buildings at the early childhood, elementary, middle, and high school levels. The most recent district information, based on Midwest's website (2007), indicates a graduation rate of approximately 95% and new teacher salary starting at about \$35,000.

Midwest has a long tradition of academic success. Currently, the district has an accreditation rating of "Distinction in Performance with High Achievement" by the state Department of Elementary and Secondary Education. The district saw dramatic growth of student enrollment in the 1980s and 1990s, due mostly to urban sprawl; the district is located just 20 minutes from a large metropolitan area. Recently enrollment in Midwest has begun to level off. Midwest's enrollment rate may be slowing because, while there was a surge of new housing developments in all of the different communities within the district, there is increasingly less land available for new homes.

At the onset of this study, before any observations were made, documents were obtained, or teachers and administrators were contacted, I obtained approval from the University of Missouri-Columbia's Institutional Review Board. Part of this process involved sending a permission letter to be signed by the Midwest School District administrator who oversees district data analysis and quality control (see Appendix A).

This letter provided the district's permission for the study to take place within district buildings and with district employees.

Participant Selection

Teacher sampling. New middle school science teachers were selected to be interviewed for this study based on the following criteria: (a) they taught full-time in the district; (b) they worked at a middle school building in Midwest School District; (c) they were certified to teach science at the middle school level; and (d) they were identified by a district science coordinator as having 5 or fewer years of science teaching experience at the middle school level. All teachers in Midwest School District who met these criteria were offered the opportunity to participate in the research. I emailed an invitation (see the recruitment email in Appendix B) to participate to the 13 teachers who met the aforementioned criteria. Of those invited to participate, 12 accepted and 1 declined. Each of Midwest's middle school buildings was represented by the study's sample population of teachers.

Those teachers who took part in the study had various work experience. They ranged in age from mid-twenties to mid-forties. Three of these new middle school science teachers were second career teachers, meaning that they had worked in the private sector before returning to school to earn a teaching certificate. Five of the participating new middle school science teachers had teaching experience at the elementary level before moving to middle school. One of the teachers had a few years of experience teaching in another school district, had taken time off to raise her children, and had recently re-entered the profession at the middle school level. The remaining three participants were

“traditional” new middle school science teachers who entered their first teaching assignment straight out of college.

Administrator sampling. District-level administrators, or those administrators who work at central office level, rather than at the building level, were selected to be interviewed for this study based on the criteria that their job description involves the following: (a) oversight of science teachers, and/or; (b) oversight of teacher professional development, and/or; (c) provision of accountability of the leadership that is provided to middle school science teachers. Five district administrators in Midwest School District met these criteria, and all five were offered the opportunity to participate in the research. I emailed an invitation (see Appendix B) to participate to the five administrators who met the aforementioned criteria. Of those invited to participate, all five accepted.

Two district administrators interviewed were Midwest’s Science Coordinators. They are in charge of all science teachers for grades K-12. These science coordinators help train new middle school science teachers in their curriculum, help plan science professional development activities throughout the year, and help organize and implement district and science initiatives to be delivered to teachers on an ongoing basis. One district administrator was Midwest’s Director of Staff Development. This administrator has oversight of the district’s entire professional development program. This administrator is also in charge of planning and organizing the district’s induction program and mentor program for new teachers. The other two district administrators were Midwest School District’s Superintendent and Associate Superintendent. Both of these administrators play vital roles in planning and organizing all programs within the district.

They work with building level principals, who help deliver site based professional development programs at the middle school level.

Data Collection

Data refer to the “rough materials researchers collect from the world they are studying; data are the particulars that form the basis of analysis” (Bogdan & Biklen, 2007, p. 117). Qualitative studies typically use a variety of data sources. In this study, where I focused primarily on understanding teacher and administrator perceptions of science professional development, I relied heavily on interviews of both new middle school science teachers and district administrators. Observations of professional development trainings and retrieval of district documents were other data collection methods used in this study.

Interviews. Interviews were a primary means of obtaining data in this study. Specifically, I conducted semi-structured interviews. While a structured interview involves a set of predetermined questions, a semi-structured interview as “a structured interview, combined with open-ended questions” (Fraenkel & Wallen, 2003, p. G-7). These interviews obtain information that can later be compared or contrasted. Informal, open-ended questions allow some latitude and flexibility to probe deeper when certain responses are unclear or in need of elaboration. A key strategy, recommended by Bogdan and Biklen (2007), which I tried to utilize during interviews, is to avoid questions that can be answered by “yes” or “no.”

Thomas and Brubaker (2000) describe the response-guided approach as consisting of an interviewer “beginning with a prepared question, then spontaneously creating follow-up queries relating to the interviewee’s answer to the opening question. This

technique enables the researcher to investigate in some depth the respondent's detailed comprehension of issues to the initial question" (p. 152). This approach certainly applied to the interviews conducted during this study. A core set of questions for both teachers and administrators were prepared in advance.

Upon meeting for the interview, each participant was asked to read and sign a consent form (see Appendix C). After establishing rapport with each interviewee, and following a brief discussion about the study's purpose, participants were provided a list of the interview's core questions (see Appendix D for teacher questions and Appendix E for administrator questions) to which they could refer throughout the interview. Due to the inductive nature of this study, and based on responses to particular questions, interview questions were added or follow-up questions were incorporated throughout the process.

A total of 17 interviews were conducted (12 new middle school science teacher and 5 district administrator interviews) between March, 2008 and May, 2008. A digital audio tape recorder was utilized during all teacher and administrator interviews to record the conversations. Interviews ranged in length from 30 to 60 minutes. After each interview was complete, I transcribed it, verbatim. In total, 253 pages of single-spaced interview transcripts were collected. These transcripts would later be coded and sub-coded for data analysis.

Observations. While interviews were the primary means of data collection, I also conducted observations of district professional development activities. This offered me insight into what actually occurs during professional development opportunities for new teachers. Fraenkel and Wallen (2003) refer to nonparticipant observation when

“researchers do not participate in the activity being observed, but rather sit on the sidelines and watch” (p. 451). In addition, these were naturalistic observations, in that I made no effort to manipulate variables or to control the activities that were being observed. I observed seven Midwest School District professional development sessions between February, 2008 and August, 2008. During each of these observations, I took descriptive fieldnotes (Bogdan & Biklen, 2007) that detailed the physical setting, events, activities, and participant behaviors.

Two of the observations were of professional development sessions for all new teachers, not just new science teachers. These sessions addressed ways to improve classroom management, structures, routines, and cooperative learning elements. In each session, there was a primary facilitator who introduced a topic and then arranged for small group activities.

The other five observations occurred during new teacher orientation at the beginning of the school year. The first two science training sessions were exclusively with new science teachers, while the third science observation was with all district science teachers. One curriculum training for new math teachers was observed. In addition, I observed top district administrators speak to a large group of new teachers from all disciplines and grade levels regarding many district initiatives and expectations.

Documents. Documents were used to substantiate or counter information from other data sources. For this study, official external documents played a role in triangulating data. Triangulation refers to “the use of multi-data sources or theoretical perspectives in a study” (Bogdan & Biklen, 2007, p. 275). Review of these documents before, during, and after the interview process provided some insight into the district’s

professional development philosophy. I collected nine documents relevant to this study. Examples of documents collected include the binder provided by the district to new teacher mentors, the schedule and description of new teacher orientation sessions, and the annual summer professional development catalog.

Data Analysis and Interpretation

Bogdan and Biklen (2007) say the best way to analyze qualitative data is to do it simultaneously with data collection. After each interview, I searched for common ideas, which eventually would become coding categories. The development of a categorization or coding system involved several steps. During and following interviews, data were continually searched for patterns and topics. Those words and phrases became categories, and helped in sorting the material. “Categories and subcategories (or properties) are most commonly constructed through the use of the constant comparative model” (Merriam, 1998). Categories were influenced by the interview core questions. For example, one of the first teacher questions pertained to the induction process, which naturally led to the development of a category that spoke to induction.

As previously mentioned, all interviews were transcribed, verbatim. This yielded a total of 17 transcribed interviews, and a total of 253 pages of single-spaced interview transcripts. After transcription was complete, I created separate documents for each interview question. From each respondent’s transcribed interview, I copied and pasted the data that related to each interview question into a new document. This was done for every interview question and yielded 26 documents. In other words, each interview question, along with its related follow-up questions, now had its own document, which included the responses from all study participants.

As this study was inductive in nature, codes were modified and continued to develop throughout the data collection process. A total of 30 codes/sub-codes eventually emerged. The codes were ultimately developed based on the direction of interview questions and follow-up questions, as well as interview responses. The next step involved taking each of the 26 documents and applying the 30 codes/sub-codes (see Appendix F). To facilitate the process, codes and sub-codes were numbered, based on the theme or category (e.g., 1.1 Induction Content Usefulness or 1.5 Induction Support System Effectiveness).

After the first round of coding was complete, I created separate documents for each of the 30 codes/sub-codes. For example, the first of these was titled “1.1 Induction Content Usefulness,” and all interview data from the 26 previously coded documents were cut and pasted into this new document if it spoke to induction content. This was done for every code/sub-code, and yielded 30 new documents.

Then, when each of the 30 codes/sub-codes had its own document, I highlighted text and put memos within each document. The memos provided explanations for why the data were placed in that code/sub-code. For example, I highlighted text from “1.1 Induction Content Usefulness” and wrote a memo that noted classroom management as a type of content that a participant found to be useful. This process, while time-consuming, then allowed me to easily flip through each code/sub-code document and check memos for patterns. Some of the memos acted as a descriptive summary of the interview text, and might describe such things as professional development content being useful because it was subject-specific and modeled during the training.

During and following interviews, I wrote reflective fieldnotes, or memos (Bogdan & Biklen, 2007). Memo writing involved my ongoing reflections on specific comments and themes made during interviews. Often, memos tried to address how or why a topic emerged and how or why it helped to answer my research questions. These reflections recognized noteworthy issues or points of interest that would later be analyzed and interpreted.

Coding families that were used to categorize data in this study include “Definition of the Situation” codes and “Perspectives Held by Subjects” codes. Bogdan and Biklen (2007) define the “Definition of the Situation” family of codes as explaining “how the subjects define the setting or particular topics” (p. 174). It includes how teachers define their work and what is important to them. The “Perspectives Held by Subjects” family of codes indicates “orientations towards particular aspects of the setting” (Bogdan & Biklen, 2007, p. 175). It involves phrases that teachers in the study often used, such as “feeling overwhelmed.”

Merriam (1998) suggests looking for data saturation of categories and exhaustion of sources to help determine when the researcher has enough data to answer the research questions, or if any additional data collection is necessary. Data saturation is “the point of data collection where the information you get becomes redundant” (Bogdan & Biklen, 2007, p. 69). Due to the grounded theory nature of this study, there was ongoing interplay between data and interpretations. When saturation of data occurred on a specific topic, I adjusted subsequent interview questions to focus less on that saturated topic so that other facets could be explored, as appropriate. For example, while core interview questions

always remained the same, on later interviews, I may not have spent as much time on follow-up questions on which previous questions had reached data saturation.

Issues of Validity, Reliability, and Trustworthiness

All data collected, including audio recordings of interviews, interview transcripts, documents, observation notes, and fieldnotes (memos) were compiled, to ensure that decisions made during the research process can be reviewed and verified. Internal validity deals with how research findings match the reality of a situation. External validity relates to the extent to which one study's findings can be applied to other situations. In qualitative research, internal validity is more of a concern than external validity. Qualitative researchers generally view reliability as a fit between recorded data and what actually occurs in the setting under study (Bogdan & Biklen, 2007).

Merriam (1998) describes the importance of triangulation in enhancing the internal validity of qualitative research. Triangulation involves the use of multiple data sources or methods to confirm the emerging findings. In this study, interviews, documents, and observations were all examined and used as back-up evidence for emerging ideas and themes.

It should also be noted that I have taught middle school science for the last 12 years. Because of these experiences, I have my own opinions on what is quality professional development for science teachers. I believe my science education background was a benefit when trying to understand participants' points of view and concerns. It is possible, though, that because of my familiarity with science professional development, I may not have fully probed into some participants' responses.

Additional checks of reliability were made with peer examination. Throughout the research study, I communicated with my research advisor, who commented on my decisions on coding categories and emerging themes.

CHAPTER FOUR: PRESENTATION OF FINDINGS

In this chapter, I present findings that explain how supported new middle school science teachers are when learning new information in professional development programs and trainings offered by Midwest School District. Observations and documents often provided additional support to interview data, and are mentioned when applicable. Interview data examined specific programs, such as orientation, mentoring, and science curriculum training. The data suggested the existence of context and content barriers that surround professional development for new middle school science teachers who are trying to implement changes into their practice. Interview data elaborated on the professional development delivery methods used with new teachers, as well as perceptions of the effectiveness of certain formal and informal training that Midwest used to support new teachers in their reform and improvement efforts. The data also suggested that Midwest provided a variety of adult learning opportunities and support groups.

Interview data broke down into five categories: induction, mentors, science-specific professional development, barriers to implementation for science professional development and district initiatives, and the role of adult learning in district professional development. The first category discusses new middle school science teacher and district administrator perceptions on how effectively Midwest School District's induction program met the learning needs of new science teachers during their first 3 years of teaching. The second category discusses the perceived usefulness and effectiveness of Midwest's mentoring program, along with other support groups that supported new science teachers during their first years in the district. The third category explains the

perceived effectiveness of the content and delivery methods used when training science teachers in science content knowledge and instructional strategies. The fourth category discusses the perceived barriers that may have affected new science teachers' actually making changes in their practice. It also addresses the perceived factors that kept new science teachers from implementing ideas learned during district training. The fifth category shares what types of adult learning occurred during Midwest's induction program, staff development days, and other district-sponsored professional development offered to new science teachers.

Each of the five categories further broke down into subcategories. These subcategories help the reader understand how new middle school science teachers and district administrators perceived that category's content and structure, delivery methods, and leadership and support systems. Findings were further organized according to teacher and administrator responses, and whether information in each category was perceived as useful or not, and effective or not. Some excerpts from interviews are provided to help explain particular points or to give examples of why participants perceived certain activities to be useful or effective. The coding key that was used to organize and categorize interview data is found in Appendix F.

Perceptions of Midwest's Induction Program

Some interview responses fell under the category of Induction. Within this category, interview responses were further divided into three subcategories that discuss: (a) perceptions of induction *content and structure*, (b) perceptions of induction *delivery methods*, and (c) perceptions of the induction program's *leadership and support systems*. Findings in this section will discuss new teacher orientation and other induction training

for new middle school science teachers. New teachers found many issues with the amount of content and the type of delivery used during new teacher orientation.

However, most felt supported by their team members and grade-level job-alike science partners during their first few years of teaching. This category will provide detailed findings of teacher and administrator perceptions of Midwest's induction program.

Induction in Midwest School District is a 3-year program designed to deliver professional development and district initiatives to new teachers through both formal and informal delivery methods. The structure used by Midwest School District includes many components, including: formal summer workshops for new teachers before and after their first years of teaching, informal summer workshops, informal collaboration time set aside for new teachers to work with other science teachers, a formally structured new teacher orientation (or induction) week, assignment of an official mentor, formal and informal participation in site-based professional development at individual middle school buildings, and ongoing formally scheduled district wide half-day and full-day pull-out professional development sessions throughout the 3-year induction program. Midwest's induction content focused primarily on classroom management, differentiation, elements of effective instruction, assessment and grading practices, and curriculum training.

Midwest School District's induction program was perceived by district administrators, and confirmed by receipt of state professional development awards, to be very successful and well organized. District administrators attributed their induction program's perceived success to many factors, including: the ability to be very selective in hiring quality teachers, ample funding and resources, and maintaining high expectations and accountability. Administrators thought the combination of these factors were unique

to this suburban school district, and perhaps less available to smaller, rural districts that make up the majority of the state.

Data that related to induction will be explained as they fit into each of the aforementioned subcategories. First, I will address data that deal with the subcategory of induction structure and content.

Perceptions of Induction Structure and Content

Some induction data fit in the subcategory of induction structure and content. Structure refers to how groups of teachers are placed together, as well as the timing, duration, and scheduling of trainings. Content refers to the topics and ideas taught to new teachers.

Interview data revealed that some aspects of the structure of induction programming worked well. For example, the provision of time with job-alike partners was considered useful to new teachers. Professional development offerings during times other than induction week were looked upon favorably.

Most teachers believed that some of the most useful professional development time was meeting with their team members and job-alike partners. This time was built into the middle school schedule two or three times a week, and the agenda and focus were often developed by the team members themselves. New teachers felt they could share ideas during this professional development time. Most felt this was a time for mutual exchange of ideas, rather than one-sided give-and-take. Teacher 2 explained, “I relied on more than one person...I lean on my teammates as well...I think the team concept is amazing and my team and I have gotten along great and we work well together and they help, we help each other.”

New middle school science teachers believed that the duration and timing of summer trainings allowed them to collaborate, reflect, and produce usable products, and that this time was preferred to the rushed, overwhelming orientation week or to professional development delivered during the school year. Most teachers believed professional development delivered during the school year, even through the learning communities model or teacher pull-out days, seemed overwhelming and stressed them out by adding to the number of responsibilities already on their plates. Based on my observations of summer trainings, new teachers seemed to be provided with a structure that allowed them to reflect, discuss, and produce products to immediately take back to their classrooms. Conversely, my observations of new teacher orientation week seemed to provide little time for reflection or work time on the topics being discussed. Teachers expressed a desire for more summer opportunities to collaborate with other science teachers, and they described this as an ideal delivery method and time for learning. For example, one teacher articulated this:

I think we definitely got more accomplished in that week during the summer.

Because that week before school, you have a lot of the administrative tasks to get done as well...I'm not sure that you get everything, you know, from the structured time allotment. You learn so much from just, I had Patty [pseudonym] who had been here so long. With her experience, talking with her and the team, it was equally important to give time for that as much as the structured workshops.

While there were positive comments regarding the structure of induction, concerns with the structure of induction trainings were also mentioned during interviews.

These included teachers' desire for pre-assessment and the timing of professional development offerings during the school year.

One issue related to the structure or planning of induction training was teachers' desires to be pre-assessed for their unique learning needs. New teachers could not recall any pre-assessment of their knowledge or needs when attending formal scheduled induction trainings. Teachers perceived that the structure of training was very rigid and did not take into account the individual's previous experiences. Teacher 2 put this into words when saying:

I don't think the idea of technology is so wrong. I just think maybe breaking it up into groups on how educated you are and even ask the teachers. The one problem that I can see, and it is throughout the board, is they will put in teachers in certain types of classes that have taught for 40 years and teachers that have taught for 2 years, and to me that doesn't make sense. You have to break it up into different experiences for those people. And if they would have taken that technology and taught how to do Smartboard stuff or how to set up all kinds of different things that they could teach, I think that would have been a great idea.

A difference in teacher and administrator perceptions occurred here. District administrators believed that pre-assessment of new teachers' readiness and previous knowledge was taken into account when planning for new teacher induction experiences. Administrator 3 explained that he likes "where we do a pre-test now, and if teachers in terms of grading software, if they already have...that experience, we try to compact that curriculum and move them through that quickly."

Another issue with induction structure was the timing of offerings. New teachers desired training to be spread out, reviewed, and explained in more detail throughout the 3-year program. Teachers expressed they either could not process the loads of information during new teacher orientation week or did not have enough teaching experience to fully understand and see how orientation training would be implemented in their own classrooms. If long-term trainings throughout the school year were not an option, new science teachers overwhelmingly preferred the timing of trainings to be during the summer. As Teacher 11 said, “my problem is I didn’t want to be pulled out of the classroom. I wanted to do everything during the summer. And that is pretty much how I’ve done it.”

District administrators understood that new teachers have a hard time taking in all the content during new teacher orientation week and they emphasized that more in-depth training does occur over the course of the 3-year induction program. Administrator 1 stated that “they will do a classroom management piece, a piece on how to read the curriculum document. They are going to a piece on assessment, and a basic, very basic introduction on differentiation and assessment for learning.” Administrators also believed initiatives were reviewed during formal and informal site-based professional development at the building level as follow-up to orientation week. Administrators perceived that this follow-up ensured new teachers understood induction content and district initiatives. Administrators seemed more confident with understanding the flow and structure of induction training over the 3-year period and seemed to believe those trainings in years two and three were follow-ups that met the needs of new teachers. On paper, this long-term structure seemed to meet the professional development needs of

new teachers. But it should be noted that in their interviews, the new teachers did not discuss follow-up trainings in years two and three as providing them with sufficient feedback or meeting their needs.

While the *structure* of induction programming had aspects that worked for new teachers and aspects that could be improved upon, so did the *content* of induction programming. Some induction content topics were repeatedly noted during interviews as being useful. These topics included classroom management and organization, a review of district vocabulary, learning expectations of the science curriculum, and assessment information.

New middle school science teachers found the content topics of classroom management and organization to be among the most useful pieces in Midwest's induction program. Classroom management included arranging everyday classroom routines, and setting up group discussions. District administrators commented in their interviews that they believed classroom management was a top priority for new teachers. Administrators seemed to suggest that mastering classroom management and subject content is a recipe for improvement in student instruction and achievement during those first few years. Organizational tasks and procedural issues such as making copies, finding and using science supplies, and planning to use science equipment were desirable content pieces to teachers during orientation and induction training. Teachers desired more information about employee procedures, benefits, and who to contact for what. This kind of information would have made teachers more confident in negotiating within the district as a brand new employee. Discussions of first week procedures and team building icebreaker activities were frequently listed as useful components of new teacher

orientation and induction training. Teacher 3 stated how planning for classroom procedures was useful:

You really got a chance to sit down and think about okay, what are my, how are my students going to sharpen the pencils, where am I going to put this, you know that kind of stuff you have to think about and get that done and out of the way and come up with procedures for things. And that was pretty useful.

Another content topic that was noted as being useful during induction training involved a review of the district's vocabulary. Teachers found explanations of unique district vocabulary and acronyms to be beneficial in their understanding of district expectations. I took notes during observations of new middle school science curriculum training that supported this interview data. During the observations, several new teachers were noted to ask for clarification or explanation of district acronyms. Teacher 5 explained some frustration with a lack of understanding the relationships among staff members:

I didn't really understand the role of the counselor. I didn't know that the assistant principals were typical contacts for the classroom teacher. I didn't know that the principal just steps in whenever, which is fine, I just didn't know any of that stuff. I didn't even know some of the vocabulary at the middle school level, like encore vs. core. I didn't understand all the committee names.

Induction content that addressed expectations for initiatives and curriculum was considered useful. During observations of induction training, many new science teachers were noted to ask questions related to understanding the expectations of, and rationale behind, district science initiatives. During interviews, teachers said that learning the

expectations of the science curriculum was of utmost importance. As Teacher 8 put it, understanding curriculum expectations was a valuable piece during induction training:

I guess the main thing that sticks out in my mind, teaching and testing the intended curriculum. Just make sure you are covering yourself and teaching what you're supposed to teach. It is alright to teach a little extra, just try not to go off what you're supposed to teach. I think that was the thing I remember about most.

An additional induction content topic that was considered useful to new science teachers was information related to assessments. New middle school science teachers said that observing and discussing assessment practices and lab ideas with their job-alike science partners was very important in understanding how in-depth units should be planned, how assessments have been done in the past, and how to do the short-term and long-term unit planning that involves the use of science equipment, such as microscopes and spring scales. New teachers said the ideas that came from initial meetings with their science partners or mentors was beneficial in delivering a deeper understanding of how to teach the district's science curriculum and what those expectations looked like in practice.

While the aforementioned content topics were considered useful, teachers and administrators also had some concerns with induction content. Rather than specific content topics being the concern, it seemed that the primary issue was the sheer amount of content and theoretical concepts. An overemphasis on theoretical information, such as differentiation or standards-based grading, was an issue. They desired more subject-specific content examples that would demonstrate how those theories would look in a

science classroom. Additionally, there was concern with induction content training being a review of college coursework and not curriculum-specific.

A common concern with induction content was the large amount of content being introduced and discussed within a short period of time. When asked, “So you felt like they gave you a lot of philosophy and research but really couldn’t give you some actual models or examples?” Teacher 6 responded:

Exactly! They set up the perfect situation, but I had already taught...It wasn’t a pessimistic point of view, but this is reality, I’ve been there and I know what happens...Once again, I found that the [theoretical] examples they gave were not helpful, it was, I am more a person that says all that is great, but show me how it works in the classroom.

All interview participants shared the perception that the amount of content training being introduced to new teachers was overwhelming. New middle school teachers desired induction training that focused more on subject-specific information, in addition to general ideological and theoretical training. Observations of new teacher professional development and documents collected during new teacher orientation seemed to justify the perceptions of these teachers. For example, I observed an orientation training that was approximately 90 minutes in duration which reviewed a PowerPoint presentation that had 54 slides of information to digest. Teacher 4 revealed:

You are not ready to take in, you are dog paddling. You are just thinking about assessment. So how am I going to teach something and assess it? Not that I am going to get feedback from my kids and be able to revise how I am teaching or re-

teach or move them along. I think at that point, you don't have any experience, so how are you going to take that information and do anything with it?

Teachers said they could not immediately implement, or even have context with which to understand, many of the content pieces introduced during new teacher orientation week. Teacher 11 stated, "I probably had too much information to start with and just finishing up school. So, some of that I think I would have benefitted more having maybe taught at least a semester and then taking it."

New middle school science teachers painted a picture of multiple complex teaching theories being thrown at them along with a thick handbook for later reference. New teachers understood and saw the future value of the content that was presented. But they felt it was not useful to them because they could not implement all of the strategies at that stage of their career. Teacher 8 described that there was "...too much for maybe a first year teacher to be able to use as often as maybe teachers who had taught 10 years, 20 years...Because at the time I came in, it was so new to me, it was confusing."

Another concern was that teachers considered some of the content during new teacher orientation week and during the 3-year induction program to be redundant and a review of the coursework that they had just completed in their education degree programs. Instead, they desired more training that reviewed what to do with the curriculum. Teachers felt that, at times, curriculum training involved simply receiving a written copy of the curriculum. "Basically I felt that it was very much a refresher course of just what I had finished in college. I didn't feel like it was anything new that I didn't get when I was completing my training [teaching certificate]," said Teacher 10. New teachers hoped for more detailed training that showed them how to deliver a concept, not

simply what the concept was. For example, teachers requested more training on how their assessments should be designed to meet the goals of standards-based grading.

It seemed that consideration of both the structure and content of induction programming was critical in creating success for new science teachers. The structure, or groupings and timings of induction trainings, mattered. But the content, or actual “meat” of the trainings, also played a role in the success of induction. New middle school science teachers wanted to structure as much professional development as possible during the summer to allow them more time to work and process the information. Teachers also found the content of classroom management, organization, curriculum training, and assessments to be some of the most useful during their first few years in Midwest.

Induction Delivery Methods

Delivery methods refer to how topics and ideas are actually taught and how the new middle school science teachers learn and respond to the content. Are the teachers asked to sit in large groups and listen to lectures? Or are the teachers being asked to collaborate in learning communities as they discover new content and district initiatives?

New middle school science teachers believed the most effective delivery method for professional development was in the form of informal teacher collaboration. This collaboration was considered informal because teachers sometimes did not have a set agenda for their work time, and were free to dive into very content-specific work, yet the structure of that collaboration time was most often scheduled and set aside for the teachers as part of their middle school weekly schedules. The delivery method that teachers found most effective is often called learning communities, teams, or job-alike time in Midwest School District. New teachers found that discussing ideas with veteran

teachers in small groups of similar grade and subject was the most beneficial delivery system of professional development. Teacher 3 said:

Those [orientation workshops] seemed like, “What the hell are you talking about?” But when you talked to Sue [pseudonym], it was like, “This is how you differentiate between these four simple concepts in action. Maybe that could be something you could do, developing lesson plans.” Like I meet with Ben and Tina [pseudonyms]. I never met with those guys [during orientation week], like “Hey, what are we teaching this year? What are we teaching tomorrow?” Meeting with your content area, coming up with a plan for the year, that is the stuff, maybe meeting with specific teachers.

In response to hearing that teachers believed professional development in learning communities was most effective, some district administrators referred to Rick DuFour’s professional development work on learning communities. They shared that this was the type of delivery system they are trying to implement at the middle school level in Midwest School District. According to Administrator 2:

The most useful staff development...is where a teacher is working with another teacher in a learning community situation. You have a group of teachers teaching the same content and they are sharing their best practices, they are sharing their assessments, they are planning units together. That is to me the highest form of professional learning, and it is where teachers learn the most, when it is really related to their specific course, content and their collaborating. I think collaboration is the key.

One key problem with the district's induction delivery methods related to new middle school teachers wanting to hear about strategies being used in the classroom, as opposed to just theory-based research. New teachers clearly felt the formal large group induction sessions used too much direct lecture, had too much paperwork and information, and were too theory-based. Teacher 4 stated:

I am a concrete learner. If you are going to present something to me, don't give me theory at that point. Say okay, this is what another science teacher has done. Let me give you a bunch of examples. Here physical science, earth science, gives me something concrete because then it is easier to transition to like, oh I am going to teach this. I mean like for kids, you model something for someone and it's easier for them to implement it.

Instead of large group, theoretically-based lectures, teachers desired more teacher collaboration time in small, subject-similar groups that would allow them to set their own agenda for that collaboration time. New teachers said that having time to collaborate and discuss with veteran teachers and mentors increased the likelihood of making changes to their practice and actually implementing new strategies and ideas.

Perceptions of the effectiveness of induction delivery methods for new middle school teachers varied greatly depending on how the trainers grouped new teachers, how trainers chose to present the material, and how well trainers allowed for teacher engagement. As mentioned above, new middle school science teachers in Midwest found small groups composed of grade-level science teachers who collaborated on actual content materials to be the most successful form of delivery offered to them in their first few years. Teachers felt that the large group lectures they experienced at some

professional development sessions did not engage them in discussion, did not relate to their subject, or left them feeling responsible for making the link between new material and their particular classrooms. New teachers agreed that orientation week was an example of a delivery system they did not prefer. Conversely, job-alike collaboration during the regular work week was widely considered to be a more ideal way to deliver district initiatives and content information.

Induction Leadership and Support Systems

The effectiveness of leadership and support groups speaks to how professional development trainers, mentors, building-level principals, and middle school teams worked with new teachers. It involves ensuring that new teachers have ownership in their professional development content, providing opportunities for the development of relationships, and offering appropriate feedback and follow-up.

Teachers had mixed perceptions regarding a feeling of ownership of the professional development content provided to them by the district in the formally scheduled induction training sessions during their first 3 years. Some said their professional development content pathway was predetermined by a top-down model of leadership which gave them no choices. Induction documents collected seem to have predetermined content, dates and times. On the other hand, a few teachers felt like they had many options if they wanted to be proactive and seek out additional resources and opportunities. They expressed that the district provided a wide range of professional development content topics, but most believed a majority of the responsibility in pursuing those topics ultimately fell on the shoulders of the new teacher. Teacher 12 said that the

district touched upon so many topics, but “there wasn’t enough time to process and ask questions during the regular orientation for the new teachers.”

New middle school science teachers felt that the most effective support system was one that allowed them to make contacts and relationships with other science teachers, district science coordinators, job-alike teammates, and grade-level teammates. Teachers stated that the bonds and relationships they formed with teammates, mentors, and staff during those first weeks of induction, and during the first 2 to 3 years, made for a more comfortable and positive experience that lead them to feel supported. The most supportive and useful professional development was perceived as being subject-specific, collaborative, product-producing, and allowing for reciprocity of ideas and resources between teachers of the same grade and subject level. Teacher 1 expressed this:

For me, the thing I used the most were my two job-alike people. One happened to be my mentor also, so there was a dual role. Just working together. The mentor had been there previously, the other job-alike person was brand new, so we relied on each other as in what are we doing. And just surviving the first year and making it through and then we used the person who had been there to help us. That helped with pacing, teaching, getting you used to the curriculum.

Those teachers who reported not feeling supported did not elaborate on special connections or friendships made during their first years. I noted that second career teachers seemed to have the most difficulty making relationships. They perceived team members had incorrectly assumed they didn’t need extra support, perhaps because of their previous life experiences or older appearance. Teacher 5 expressed this concern:

When you walk into a position in business, the drawers are not empty. They are full with all the historical files, you are not starting from day one, everybody there is there to assist you to get you up to speed, because the longer it takes you to get up to speed, the more money is wasted. Education is the exact opposite. You walk in and you have nothing. And you're reinventing the wheel that has been reinvented a millions times before, and you are doing it again. You're developing, you're finding your own labs, you have to order your own materials, you're developing your own lessons, you're still deciding the sequence in which your going to teach your units, and that is such a terrific waste of time.

The other key issue of leadership and support that new middle school science teachers mentioned was the issue of adequate feedback and follow-up to ensure new teachers were actually changing and improving their practice in the classroom. New teachers said that there was simply little or no follow-up on district trainings and initiatives. Additionally, teachers felt like too many ideas and initiatives were constantly being introduced, and leadership gave them unclear expectations regarding timelines for or accountability of implementation.

District administrators said they relied heavily on building-level leadership and the system of support built into site-based professional development to help identify individual teachers who need extra feedback and follow-up training. According to Administrator 2:

The other recommendation that came out of it [district committee] is to make sure that there is another leg of support so the professional learning community, the job-alike team and then somebody monitoring that. And that is where I don't have

the resources right now. Our district is so large we hope to in the future have instructional coaches that will be another like a support for the new teachers in each of those years one, two, and three, that are all overseeing the mentor program and the new teachers are to check in with them [instructional coaches].

District administrators agreed that additional support was needed to help teachers make changes in their practice. Administration provided several desired measures they hope to implement in the future, but admitted that at the time of data collection, they relied primarily on teachers to self-identify, or on building-level leadership to help identify teachers who need extra support.

It seemed that the glue connecting the aforementioned issues of ownership of professional development, relationship-building, and appropriate feedback was how well the building-level principal implemented the learning communities model. District administrators perceived that implementation of the learning communities model of professional development fostered the most appropriate atmosphere for adult leaning and building relationships. Yet, district administration estimated that currently, less than half of the middle school principals in Midwest School District were properly implementing quality professional learning communities. Administration mentioned a desire for improved long-range planning for professional development in Midwest, additional personnel support in the form of instructional coaches to improve teacher implementation and feedback issues, and better training and accountability for building-level principals in order to unify the message on how to deliver professional learning communities that support teacher relationships. Administrator 2 hinted at this:

The school improvement plan of course is on paper and so, what comes in on paper doesn't always translate to practice...So, um, together we are working with the principal to try to shift the principal's perception of professional development, and help the principal understand what should happen...it has become apparent to me that the principal is not fully aware of what constitutes high quality professional learning.

Teacher and district administrator interview data revealed discrepancies in different building-level leadership's ability to manage and implement high-quality learning communities. The effectiveness of implementation of the learning communities model impacted teachers' overall perception of support during the first 3 years. Some teachers did not feel supported when they first entered Midwest School District, while others had a satisfactory experience provided by their support groups. New middle school science teachers desired ongoing subject-specific support and feedback on their lessons and labs. They wanted a balance of modeling and sharing of ideas from their learning community counterparts. When collaboration happened, teachers perceived they were adequately supported; when collaboration was not provided, teachers felt isolated and lacked direction on their performance. Interview data revealed that the key to providing teachers with a successful learning community model seems to be the quality and experience of the building-level principal. In Midwest, it seemed that some principals were developing learning communities that met new teachers' needs, while other middle school principals lacked the skills or training to foster a collaborative atmosphere.

Summary of Perceptions of Midwest's Induction Program

To summarize, teachers found several topics useful when attending district professional development training in their first few years. Sessions on classroom management, science curriculum, and district expectations on initiatives were mentioned as the most useful. Analysis of documents and administrator perceptions suggested that induction week was well organized, structured, and contained appropriate content. New teachers, however, described the induction experience as overwhelming with too much theoretical information in a short period of time. Teachers did not find the information useful at that point in their careers. Teachers expressed concern that trainings were too theoretically-based and gave few examples on how concepts would be delivered in a science classroom. Professional learning communities model, along with summertime workshops, were ideal delivery methods for professional development content. Teachers' least desired delivery method was formal large group lecture because that did not allow for collaboration or relationship-building.

Leadership played a key role with teachers' perceptions of feeling supported, forming relationships, and learning and implementing professional development. Many teachers explained that leadership often structured induction professional development in a top-down model. Leadership reportedly provided vague expectations with little or no follow-up or feedback on many initiatives. District administrators agreed that the quality of building-level leadership varied from building to building. The quality of this leadership varied in terms of understanding and implementing professional learning communities. District administrators also planned to improve issues with follow-up by

adding several components to the long-range planning for professional development in Midwest School District.

Perceptions of Midwest's Mentoring Program

Some interview responses fell under the category of Mentoring. Within this category, interview responses were further divided into three subcategories that discuss: (a) perceptions of the mentor program's *content and structure*, (b) perceptions of the mentor program's *delivery methods*, and (c) perceptions of the mentor program's *leadership and support systems*. New middle school science teachers perceived their mentors as being the most useful when the mentor was in close proximity to their rooms and when they built not only working relationships with each other, but also personal connections. This section elaborates on other variables and barriers expressed by new middle school science teachers when reflecting on their mentor experience.

The mentor program in Midwest School District is a 2-year program for new teachers who enter the district with no previous teaching experience. Beginning teachers are assigned a formal mentor by their building principal. The formal mentor serves in that role during the beginning teacher's first year in the classroom. In the teacher's second year of teaching, the mentor program is provided through the district through Assessment for Learning professional development training. This method of mentorship is recognized by the state in which Midwest School District resides, and serves to fulfill the state certification requirement that teachers participate in a 2-year mentor program.

The district assigns a mentor, who ideally meets the following criteria: has at least 3 years of teaching experience, teaches similar grade level and subject, and has completed the district's mentor training within the last 5 years. Mentor training provides

mentors with a handbook, which I obtained as a reference document. The handbook organizes and explains the program's expectations and activities to be delivered to the new teacher. Mentors are expected to meet at least once a month to discuss an array of topics outlined in the handbook such as classroom management, lesson design, and assessment practices. Mentors are expected to coordinate classroom observations, provide new teachers with certification requirement information, be available to assist in areas of concern, and suggest improvements if needed.

Data that related to mentoring will be explained as they fit into each of the previously mentioned subcategories. First, I will address data that deal with the subcategory of mentoring structure and content.

Perceptions of Mentoring Structure and Content

Some of the mentoring data fit in the subcategory of mentoring structure and content. Structure refers to the timing, scheduling, and format of mentor-mentee trainings and interactions. Content refers to the topics and theoretical or practical concepts that are planned to be passed from mentor to mentee.

New middle school science teachers had some positive comments about the structure of the district's mentor programs, yet most new teachers elaborated more on the perceived ineffectiveness of the program. Teachers who had positive mentor experiences thought that meeting and collaborating at the beginning of the school year was more ideal than the sessions during second semester. Teachers said the initial meetings were an ideal time to help them understand the school culture and building politics, and to navigate the basic orientation of the building, such as how to use the copier and locate the nurse's office. Additionally, those administrators who were more involved with planning and

organizing the mentor program believed content and structure, such as mentor training and the mentor handbook, were instrumental in the success of the program.

One aspect of the structure of the mentoring program that new middle school science teachers found ineffective was the time and effort required to set up and plan for classroom observations. Teachers believed observing their mentor's class and having the mentor observe the new teacher's class was not a good use of time compared to the perceived value of the activity. Teacher 3 explained this:

We had to get stuff signed. We didn't keep up on it. I think she knows she didn't do the greatest job as a mentor. I know being a mentee, I really had no idea. I just relied on her. She was getting paid for it to figure out how to get it done. Or maybe I did observe people but I didn't get time off to go observe people that I found that useful. She had a lot of good classroom management things that I would never do.

Teachers said planning for a substitute and coordinating the observations seemed to be more stressful and memorable than any of the advice that could be recalled. Furthermore, collaboration time and feedback was minimal after most observations. Teachers felt that the observations were conducted more to satisfy the requirements of the program than to improve practice.

For those new teachers who were not in direct proximity of their mentor, it was perceived that the due dates for turning in sections from the district's mentor handbook dictated when mentors desired to meet. New teachers said if the mentor was off team, on a different grade level, or taught another subject area; the structure of meetings, observations, and collaboration was very difficult to coordinate. This led to the new

teacher perception of the organization and structure of the program as not being useful or an effective use of their time. The district's mentor handbook included a checklist of topics and times of the year when meetings were to occur. Teacher 3 said:

She had no idea what she was doing; it was a burden on her. She was doing it because she had to. And there was no one else to do it. So I appreciate that, but it was no value to me. The idea I think is you meet someone you can rely on and you count on, like your little buddy who helps you. They help you work through some stuff. And that was not what it was. Or someone that relies on you and keeps you focused. Maybe talks you down from a bad day, or talks up or helps you stay positive and motivated. I saw her like I said, she called me when she wanted me to sign, and I came down to sign it. That was it.

Comments were made regarding new middle school science teachers who had a few years of previous experience from another district or who transferred from elementary grade levels. These individuals said they were not provided an official mentor when they started teaching at the middle school level. Those teachers said they would have been open to being assigned a mentor for this new work position if the district would have offered one.

Researcher: Did you have an official mentor?

Teacher 12: No, No.

Researcher: They probably just called it a buddy or something?

Teacher 12: Yeah, and that was something new since I had first started teaching.

When I first started, they just threw you in there and closed the door.

Researcher: Was that buddy, was that the team leader, was that somebody else, do you know, 4 years ago in Midwest?

Teacher 12: I don't think there really was anybody in particular, but I guess I had known enough to know who to ask. Then again, I called the science coordinator with a lot of those questions.

Perceptions about the *content* of Midwest's mentor program mirrored those related to *structure*, in that there was more elaboration on negatives than positives. Those new middle school teachers who had positive perceptions of the mentor program were those with common planning periods as their mentor, close proximity to the mentor, or a previous relationship such as having been the mentor's student teacher. New middle school science teachers said the most useful content provided in Midwest's mentoring program was sharing practical relevant subject ideas and materials during collaboration time. Specifically, teachers found the content topics of classroom management techniques, lab design and set-up, reviewing curriculum requirements, unit pacing, and resource sharing to be the most useful topics to discuss with mentors. As Teacher 10 explained:

Well, we did everything. We went through the checklist of all the stuff we had to do. We did observations, we talked about things that could be improved. I will say that my mentor's also our department chair. And so, I want to say he was extremely open to a lot of things... he also put in place this year, when we were going to hit a certain chapter by so we have a timeline for next year. We have our next year's schedule already made.

District administrators who were involved in organizing the mentor program had positive comments about the program's content. Administrators commented that only a small minority of teachers will not experience a high quality mentor. Administrator 2 said:

The key points are the observations--they need to make sure that they are observing and giving feedback, that they are helping you, that the new teacher stays on track with certification requirements, and that they are there for support. You know, just you know refresher on that. They are there to help them not only informally but in some formal ways with planning lessons, observing, giving feedback.

The content of the mentor program was noted to be problematic for most new middle school science teachers. The district mentor handbook used by mentors to stimulate conversation and collaboration was not perceived to have much value by new teachers. Furthermore, new science teachers thought the district-required paperwork was a burden for the mentors and was perceived as something the pair had to do, rather than a springboard for discussion topics. Topics from the handbook often dominated the discussions, and new teachers said that when this happened, they had little ownership of the agenda of scheduled mentor-mentee meetings and discussions.

Teacher 11: We really didn't spend that much time sitting down together. But I knew if I ever had a problem, like I was having one very difficult student and she had her the year before. And she just was there to help and gave suggestions, so I always felt that if I needed something she would be there. But we did not sit down and spend a lot of time together that first year. Just because we are all so busy.

Researcher: Do you remember her going through a binder, a checklist and things that she had to do each quarter?

Teacher 11: She did. I do remember that.

Researcher: Did you find that useful?

Teacher 11: I don't remember it being that useful.

Similarly, district administrators who were less involved with the planning and implementation of the mentor program, perceived the amount of content that mentors are expected to cover as overwhelming. They asserted that the amount of paperwork was excessive considering the perceived benefits of support for new teachers. They believed the lack of mentor training and accountability built into the district's mentor program led to the perception that many new teachers, not just a small minority, struggled with learning and mastering the content and strategies contained in the mentor handbook.

Administrator 4 expressed some concern for the mentors:

The only thing is that to me, it is way over-paper worked, in my opinion. Those mentors that do that, there is a lot of pull-out time. They always have this massive binder of paper of things they are supposed to do and they are not doing that with the mentee because they don't need to go through all of that. I think it needs to be much more subject-specific, give them time to work.

Several aspects of structure and content were perceived to make for a quality mentorship program for new middle school science teachers in Midwest. Teachers desired their mentors to be in close physical proximity to their rooms, to share the same plan times, to teach the same subject and grade level, and to allow the new teacher to collaborate on subject-specific ideas during their meeting times. Teachers wanted the

collaboration to focus more on unique classroom struggles and curriculum topics than on generic discussions brought forth by the district's mentor-mentee handbook. It also seemed that those new middle school science teachers who had some experience at the elementary level desired more mentorship and support. These teachers found middle school to be different enough from their previous workplace to make them feel like first year teachers in many ways, particularly when dealing with science curriculum. As will be addressed in Chapter Five, these issues highlighted the importance of mentor selection as well as mentor training that goes beyond a monthly checklist in a mentor handbook.

Perceptions of Mentoring Delivery Methods

Delivery methods refer to how topics and theoretical or practical concepts are actually taught and how trainers deliver that information. They also include the methods through which the material is presented. Are teachers listening to lectures, or are they being asked to collaborate with their mentor?

Most comments related to the mentoring program's delivery methods were positive. New middle school science teachers found the most effective delivery method for the mentor program to be collaboration time with their mentor. New middle school science teachers had very clear criteria for the variables that surround successful collaboration, and these variables were discussed in the previous section on content and structure. The variables that helped foster high quality collaboration were: sharing common planning times, and being in the same subject area, same grade level, and in close proximity to their room. Teachers who found the mentor program to be delivered to them effectively said those variables were keys to relevant collaboration and discussions. Teacher 8 found the mentor helpful:

The other science teacher that I worked with in sixth-grade, she was my mentor. If I had any questions related to science she was definitely the person that I would go to. We had our job alike days where we would sit down together and we would plan out like, okay, we have four quarters, we have four [objectives], what we try to do is, she basically gave me the order and the paths that her and the other science teachers normally did things.

Another preferred delivery method was content-specific feedback. The ability to sit down and discuss grade-level science curriculum seemed to be a powerful and effective delivery method desired by new middle school teachers who had positive mentor collaboration sessions. Teachers felt that mentors who were subject-specific provided them more practical, usable information that could be implemented immediately into their own lessons. Teacher 4 stated:

I was her student teacher, and I moved into the room next to her. I knew her, she was a fabulous resource, she was my mentor, she was you know the person I threw ideas off of. I think we have similar perspectives on science and teaching styles. I think that was the person I went to when I had questions; science-related questions.

District administrators mirrored the teacher comments in their perceptions of conditions that make for a positive mentor experience. These conditions included adequate collaboration time and content-specific feedback. Information in the mentor handbook aligned with teacher and administrator comments on providing adequate collaboration time on an ongoing basis. The handbook included more than just checklists for activities that needed to be done within certain timelines. It included suggestions for

effective communication between mentor and mentee. It also included articles with facts on beginning teachers, how mentors can guide them, and district resources like calendars and dates when new teachers can meet and share their experiences with each other.

Negative comments regarding delivery methods of the mentor program were limited to being from those teachers with no mentor due to previous experience, and a few teachers who reported having poor quality mentors. These individuals said that no one seemed to proactively check in on them or provide them feedback on lesson designs and curriculum issues. These teachers did not report much on delivery methods used by the mentor. Rather, they reported feeling that their mentors were either too busy, or just wanted to sign off on paperwork with no real discussion. These teachers said the mentor made no attempt at a relationship and did not deliver any useful information.

It seemed, then, that Midwest's approach to delivering the mentoring program was found to be effective by most new middle school science teachers and district administrators. The most effective delivery found in a perceived quality mentorship was one that allowed time for discussion on topics beyond the mentor handbook, such as feedback on specific curriculum pieces, labs, and science lesson ideas. Teachers who met and collaborated on a regular basis with their mentor seemed to have an advantage over those teachers who did not form a working relationship during the regular work week. While there were a few comments related to ineffective delivery methods, these were made by teachers who lacked one or more of the following with their mentors: common planning times, being in the same subject area, being in the same grade level, or being located in close proximity within the same school building. These teachers found the

mentor experience to be less useful or perceived the collaboration as unhelpful or a waste of time.

Perceptions of Mentoring Leadership and Support Systems

Some mentoring data fit in the subcategory of mentoring leadership and support systems. In this section I address data that fit in this subcategory. Leadership and support systems refer to how professional development trainers, building-level principals, and middle school teams work with new teachers. It involves their role in the assignment of appropriate mentors, ensuring that new teachers have a positive and collaborative relationship with their mentors, and monitoring new teachers' engagement and reciprocity with multiple support groups. Mentors themselves are a critical support system to new teachers.

New middle school science teachers believed that building positive relationships with the mentor was the most useful outcome of the entire mentor program. New teachers shared that a mentor's effectiveness was primarily tied to the mentor's ability to foster a positive relationship right from the first meeting. The mentor's positive, caring attitude was said to be the most desirable attribute for making the new teacher feel supported. This was considered to be more effective than the mentor handbook's content. Teacher 2 shared:

He's been a friend before he was a mentor, so I know how there are a lot times some teachers would hold back, but I think if I ask even planning for camp, we are doing that, it is a huge project. I know a lot of people who are more scared to ask him for stuff. I go down there and say, "Hey I need this and this and this. Can I get this?" Oh yeah, no problem, boom, right away.

New teachers who felt the mentor program was ineffective had problems building a close working relationship with their mentor. Some new teachers believed that the mentors did not share similar beliefs and philosophies on how science instruction should be taught, or did not allow the new teacher to take ownership of discussions, and no reciprocity was achieved during the collaboration time. As Teacher 3 explained, “I think it was also personality-wise too. Yeah, I mean it depends on whether or not you get along with the person [mentor], and I didn’t think we got along very well.”

New teachers thought that district administration provided little training or guidance for their mentors. Teachers thought mentors lacked direction and seemed to be unsure on how to deliver mentor content provided in the mentor handbook. Several teachers said their mentors had limited ideas to share. After reflecting on the classroom observations, some teachers said they would have preferred observing someone else. They wished to observe someone whose philosophies on how to teach and deliver science instruction to students through inquiry lessons, hands-on lessons, and lessons that involved current technology more closely aligned with theirs. Comments were also made that new teachers would have liked the opportunity to observe other grade-level science teachers if their mentor was of a different grade or subject.

Those teachers who had a poor mentor experience or no official mentor because of previous work experience did speak about leadership supporting them with multiple layers of teams and other relationships. A unanimous sentiment expressed by all teachers was the support they felt from their middle school grade-level teams. Relationships with teammates often provided new teachers with a supportive group of colleagues that took the place of a mentor. Teacher 2 felt this way:

I lean on my teammates as well...I think the team concept is amazing and my team and I have gotten along great and we work well together and they help, we help each other out. If it is kids misbehaving, we'll pull...that kid in with all the teachers and have a sit down with them...everybody has been willing to help, the administration has helped me, they have always come and asked. So as a whole, I really have used quite a few different people.

Other support systems that new teachers found effective were: job-alike science teams, vertical science teams, the district science coordinators, and other science teachers from various buildings. These groups provided additional layers of support for teachers to fall back on if the mentor relationship was ineffective. New teachers rarely spoke of making strong relationships with building administrators or principals. Teachers simply spoke of principals coming in to do their standard observations, with subsequent discussions including mostly general teaching feedback and little science content feedback.

District administrators believed a crucial factor is the ability of building principals to appropriately identify and choose the mentor, and for the district to adequately train the mentor to understand how and what to cover with the new teacher. Therefore, district administrators perceived that most mentoring issues stem from poor mentor selection and inadequate district-level mentor training.

Administrators felt that the mentor selection process ultimately set the mentor-mentee pairing up for success or failure. Administrators agreed that ideal mentor selection involves choosing someone with high energy, a willingness to act as a mentor, as well as the pairing similarities based on grade and subject level. District administrators

believed mentor problems were more widespread at the high school level and not as much of a concern at the middle school level. Administrator 4 mentioned concern with this:

Maybe poor choices of mentors. We were finding as we were questioning, this was at middle school as well as high school, sometimes a math teacher is your mentor instead of a science teacher. So, not even having a mentor in your field. And out of that it is just principals saying, “Hey I like this person, I want you to mentor so and so.” Instead of who really is going to be the best for your subject area.

Additionally, several district administrators desired the hiring of additional staff as instructional coaches. Ideally, these instructional coaches would help oversee new teacher professional development, and would hopefully increase the likelihood of new teachers receiving and appropriately implementing professional development and district initiatives. The district science coordinators’ office also desired to be more directly involved with the mentor program to help with consistency of mentor quality from building to building.

The interview data seemed to beg the question: who is actually overseeing and checking in on the mentor-mentee relationship for each school and for each new teacher? Teachers said that after assigning the mentor, building principals have little to do with fostering a quality mentor relationship. Some principals were perceived to assign mentors based on personal reasons rather than choosing the most appropriate mentor for a particular mentee’s situation. District-level administrators desired more assistance from instructional coaches to provide the feedback that new teachers need to improve their

instruction and to improve mentor training. The task of mentoring is a very human endeavor that begins with leaders identifying an outgoing mentor, training them appropriately, then providing the pair with assistance and feedback on the mentor-mentee relationship itself. Problems seemed to arise when one or more of those variables were taken for granted. Interview data suggested that additional leadership assistance and support was needed, in some cases, to help foster a high quality relationship that supports new Midwest teachers.

Summary of Perceptions of Midwest's Mentoring Program

To summarize, new middle school science teachers primarily based their perceptions of the success of their mentor or buddy on several key variables. First and foremost was a sense of connection, or positive relationship, which new teachers clearly described as either being present or not. Other variables important to the success of the mentor-mentee pairing included open discussion of curriculum, proximity to each other, and mutual grade level and planning periods.

It was evident that if the mentor-mentee pairing did not gel on a personal or professional basis, then new teachers felt little true support from the mentor. District administrators explained that building-level leaders were responsible for identifying mentors and monitoring the mentor-mentee relationships. However, new science teachers generally claimed to experience little follow-up, support, or effort by building principals to ensure mentor-mentee collaboration. Some new teachers also perceived mentors to lack proper training from district-level leadership on how to support the new teachers in their care. Luckily for new teachers in Midwest, mentors were not the only support system in place. The next section includes a discussion of the multiple layers of support

that most new teachers received as they began their middle school science career in Midwest.

Perceptions of Midwest's Science-Specific Professional Development

Some interview responses fell under the category of Science-Specific Professional Development for new middle school science teachers. Within this category, interview responses were further divided into three subcategories that discuss: (a) perceptions of the district's science professional development *content and structure*, (b) perceptions of the district's science professional development *delivery methods*, and (c) perceptions of *leadership and support systems* that accompany science-specific professional development. New middle school science teachers spoke of science-specific professional development primarily as curriculum training sessions provided by the district. Several teachers could not think of science-specific training while others found several science content related opportunities provided to them by Midwest. Teachers and district administrators believed the most powerful form of science-specific professional development came in the form of informal site-based, job-embedded teacher collaboration that takes place in the learning communities model of professional development.

The science department in Midwest School District is led by two district-level coordinators who plan and organize science professional development opportunities for all teachers in grades K-12, and oversee the implementation of science curriculum for all science teachers in the district. The two coordinators are involved in curriculum training during orientation week, observing new teacher classrooms, helping with new teacher

supply orders and technology support, and being held accountable for the advancement of district science initiatives and professional development programs.

Middle school science teachers in Midwest School District are divided into several groups and teams. Middle school vertical teams are composed of all science teachers from grades 6-8 within one building who meet periodically throughout the year. Middle school job-alike teams are composed of two or three teachers within one building that teach identical courses in the same grade level. In addition, science teachers are also part of grade-level teams, which includes teachers from different subjects that share the same groups of students. Middle school science teachers are provided weekly plan time in their schedules with their grade-level teams and job-alike teams. Science professional development occurs during orientation, job-alike meetings, half- and full-day staff development sessions, and summer workshops. Furthermore, Midwest School District is able to provide some financial support to science teachers who seek out of district training and advanced degrees.

Data that related to science-specific professional development will be explained as they fit into each of the aforementioned subcategories. First, I will address data that deal with the subcategory of science professional development structure and content.

Perceptions of Science Professional Development Structure and Content

Some of the data fit in the subcategory of science professional development structure and content. Structure refers to the timing, scheduling, and format of science professional development at the district and building levels. Content refers to the practical or theoretical concepts that are planned for these programs.

Comments regarding the usefulness of the structure of science-specific professional development opportunities typically related to when and with whom science teachers collaborated. For example, administrators highlighted the structure of summer field trip offerings for teachers as experiences through which to delve deeper into specific content matter. Teachers that had been on summer field trip experiences provided positive comments about the hands-on connection to their curriculum. These teachers reported using knowledge gained from these experiences during the following school year.

A few teachers described how they enjoyed opportunities to meet with teachers from different buildings. It should be noted, though, that some of those collaboration times were arranged outside of contract times and were set up by individual teachers without prompting by district administration.

As stated in other sections, teachers overwhelmingly found the structured time set aside for their job-alike meetings each week as the most effective time to share science related ideas. Those teachers who had a good working relationship with job-alike team members said this was the most useful time during the school year for science professional development.

Interview data also supported the fact that the structure of science professional development in the district was not useful. Teachers shared that the organization and structure of science professional development was not always communicated well. Often, mass e-mails related to science professional development opportunities and district science initiatives would appear with just a few days' notice. Teacher 10 stated:

I think that if they [Midwest] wanted us to do things like science fairs or science expos, they would have made it more accessible to us to get the time off to go to those things. If you want teachers to motivate students to take part in that, then you're going to have to make the teachers see the importance of it, and the way to do that is to engage the teacher to stand with you. Sending out an e-mail saying a science expo is coming, when are you going to sign up to work a booth? (ha, ha) or a table? It's not motivating me to say, this is something I should do.

New teachers noted that the science professional development provided during large district formal professional development sessions did not meet their individual learning needs. The few large group science meetings occurred so infrequently, and for such a short duration, that new teachers did not find the structure or timing of the meetings to benefit them in terms of strengthening their knowledge of science curriculum. New teachers said these larger group meetings sometimes occurred before they had taught the curriculum, and so early in the school year was not a preferred time to debate curriculum topics which they had not yet experienced in the classroom. New teachers generally desired more opportunities with ample time to meet with other science teachers to discuss content in an informal setting. Perhaps the most telling comments regarding the impact of Midwest's structuring of formal science-specific professional development opportunities came from a few science teachers who could not recall any science-specific training at all in the past few years.

Interview data on science-specific professional development spoke more to the content. New middle school science teachers said the content of science professional development was most useful when the training was relevant to their current grade-level

curriculum. Teachers further explained that content training which provided hands-on ideas and materials for labs and activities were the most powerful and interesting professional development sessions related to science. Teachers found professional development content useful when the trainers had specific examples, went into detail on how the topic could be implemented or assessed, and provided usable products, such as sample labs or ready to use assessments. Teacher 1 shared that:

The coordinator did labs, different labs that would meet the different stuff, so that was good...Now the only other thing was, I don't know if it was at that one or the other one [science professional development training session]. We did a misconceptions thing and that I used because there is a book that they make and it is on science misconceptions. I have used those as openers, and that I liked.

District administrators perceived science training as ideal when it was content-specific, modeled for the teachers, and provided for teacher collaboration time.

Administrators emphasized science content training that focused on assessment and technology as a targeted goal for improving student learning.

Science professional development content was perceived as not useful to teachers when it was generic or a review of their previous knowledge gained from undergraduate work. Teachers felt some of the science professional development discussed during their first few years was redundant. Teachers expressed that, at times, trainers did not provide or model strategies for implementing theoretical concepts into lessons so that students would be able to learn difficult concepts. Teacher 3 said:

I went through the curriculum [training], I spent a year and a half on that. I recall it. It wasn't like what to teach, but what you do with that is something else

entirely. I don't see that to be professional development. I mean yeah, the fact that I know what the [objectives] are and I am aware of the ideas behind why we teach them. But that doesn't help me with like how I would then deliver that to students and then in a meaningful way.

The content and expectations for participation in science programs and science initiatives were vague for many new teachers. New teachers said that they questioned whether participation was mandatory or optional. Furthermore, the agendas at building and district-level science meetings were reported to be unclear or generic. Teacher 3 conveyed this sense of vagueness:

Even after being on the curriculum [committee], I'm still not sure what you want from me, do you want me to teach this or that. And they say they want you to teach the curriculum. But today we had the [vertical science team] meeting and it wasn't clear to me what we are supposed to be worried about, or what we are supposed to be focusing on.

Other new science teachers expressed a lack of classroom experience with the curriculum and planning for specific units. So they had no context with which to understand how to take curriculum training ideas, process them, and then modify their practice. Teachers desired more information on how to deliver a concept to students along with bulking up on their own content knowledge and learning. Teachers desired more curriculum content training offered through the district and said they would be interested in taking specific content training sessions if more opportunities were made available. Some teachers admitted that they didn't remember learning certain grade-level curriculum, or that it had been learned so long ago they needed a review before teaching

the unit. Some teachers couldn't recall ever having science content training. Teacher 6 said, "I'll tell you right now. None. Not a one [district-sponsored science content training]."

It seemed that the structure and timing of summer field trips and weekly job-alike times were the most effective times for new middle school science teachers to get the most out of science-specific content learning and collaboration. The structure of most other science related professional development was less effective. Because they occurred too infrequently or with such short duration, new teachers felt they really didn't benefit from large group science meetings, especially at orientation or on staff development days. New middle school science teachers also felt that little science-specific content training occurred. When teachers recalled science training, they appreciated when concepts were modeled for them and with them during the training. More training that allowed for work time with other science teachers on grade-level, content-specific material was desired.

Perceptions of Science Professional Development Delivery Methods

Delivery methods refer to how science-specific professional development is actually taught and how trainers deliver that information. They also include the methods through which the material is presented. Are teachers in formal professional development sessions listening to lectures, or are they collaborating with other teachers to discuss science?

During interviews, new middle school teachers mentioned different science-specific professional development delivery methods. While many comments about formal district workshops were negative, most teachers and administrators had positive things to say about informal professional development offerings.

Informal science professional development was described by teachers as helpful. The informal sessions allowed groups to collaborate on a variety of topics, including content, assessments, lab ideas, and best practices, without necessarily having a set agenda from which to work. Teacher 2 described:

Some of the most powerful development, professional development days I have ever had are just getting a group of people around and saying, “Bill [pseudonym], you give your experience of somebody who is a first year teacher, what was your hardest thing? Joe [pseudonym], you give yours and you have taught for 10 years, what is your hardest thing to get the kids to understand and teach?” And having group discussions, I think those are huge.

When new middle school science teachers spoke of collaborating, they reported preferring when the group used a mixed approach of idea collaboration, modeling strategies, seeing demonstrations, going on field trip experiences, and being provided enough independent plan time to incorporate ideas into new lessons. Site-based professional development provided in small, informal settings met their ideal delivery needs. Teachers perceived that the district provided them with ideal conditions for teacher collaboration during informal weekly job-alike team time. Teacher 4 said this about her new team and job-alike partner during her first years:

No big power struggles [on the team] or anything like that because the thing was pretty much set up and they would fill you in. “Okay, this is the curriculum and this is how we have done it in the past and this is how it is set up... I just found this cool activity, why don’t you try it? I just tried it with my kids and it works really good. Here I just found this and this is neat, but I changed this about it.”

Summer workshops were reported by teachers to be a more effective delivery method of science-specific professional development than similar staff development experiences provided during the school year on staff development days. Teachers said summer opportunities allowed instructors to deliver professional development in a manner that incorporated more teacher ownership and collaboration time. Most new teachers reportedly took summer workshops or participated in summer field trip experiences offered by the district. Those who participated in such summer opportunities had positive comments regarding the way the content was delivered. Midwest's 2008 summer workshop booklet noted four middle school science professional development offerings along with summer science field trip opportunities that were made available for all science teachers in the district.

Teachers said that large group lectures were the least effective method of delivering science professional development. Most middle school science teachers stated that they primarily received informal professional development for the majority of their science training. But when asked specifically about formal professional development sessions, new teachers felt those sessions needed to better provide: clear expectations of the initiative, modeling of examples, time for hands-on practice, time to collaborate with others, and some type of follow-up or feedback to help them change and modify instruction.

New teachers felt that the current formal science professional development provided by the district lacks clear expectations regarding implementation of initiatives and little feedback or follow-up to keep the ideas going and to keep teachers motivated to

incorporate lasting changes in their instruction. This was communicated during Teacher 10's interview:

She had a vision, I just think it didn't align with what we wanted to do. She wanted to show us how she created a test, but it wouldn't apply to the stuff that we had. And it was like, what is the point of that? I mean, it just, she had a precise way of what she wanted done, and she wanted to show it to us, but that is not what we needed. We wanted specifics. We had questions and there were, I think, about six science people in there all wanting to do the same thing. Between all of us, we all walked out of there going, "Okay that was a waste of time." So we just didn't get anywhere we wanted to be.

Negative perceptions associated with formal science professional development were consistent with perceptions of most formal training sessions delivered by the district. Teachers said that large groups of unlike subject and grade-level teachers made it more difficult to glean relevant examples that can be easily implemented into their science instruction.

It should be noted that new middle school science teachers and district administrators had nearly identical interview data when it came to identifying the most and least effective forms of delivering science content training to new teachers. Administrators agreed on the benefits of informal, small group science professional development as an ideal way to deliver professional development.

Interview data revealed that the most beneficial science professional development delivery methods were informal and involved use of the learning communities model of professional development. Teachers believed informal science professional development

was the most beneficial delivery system provided by Midwest. Summer offerings were also considered helpful. New middle school teachers reported that formal district-sponsored professional development opportunities were not beneficial.

Perceptions of Science Professional Development Leadership and Support Systems

Leadership and support systems refer to how professional development trainers, district science coordinators, mentors, building-level principals, and middle school teams work with new science teachers. It involves their role in providing guidance regarding district science initiatives, ensuring that new teachers have collaborative relationships in which to discuss science professional development, and a deep understanding of both the science curriculum they teach and the most appropriate teaching methods to deliver that curriculum to students.

New middle school science teachers said that when it came to learning science-specific content training, they perceived the most support from grade-level job-alike teams. Other teachers remarked on the accessibility of the district science coordinators' office as a great place for information and support. New middle school science teachers who felt supported spoke about positive school and team cultures that welcomed new teachers and helped them establish positive relationships with mentors, job-alike partners, and other science teachers. Teacher 7 shared this about her job-alike partner:

I could have not have survived the first year without her...She had materials, she had knowledge, and she had pacing, and now that she is gone, I am struggling with the pacing. So I have to sit down with Meg [pseudonym] and Sarah [pseudonym], and say, "Okay, how did you pace this stuff?" Because we taught the same things in the same order and I want to get their ideas on what they,

because we each have kind of our own thing that we like, some things we teach longer on and some things we don't.

Across the board, new science teachers perceived the district's two science coordinators as positive, supportive, and approachable during their first years. New teachers commented on the coordinators' ability to help access supplies, order materials, answer curricular questions, plan for summer workshops and field trip experiences, and provide individual or group training when requested. My observation of the science coordinator's training session during new teacher orientation found more one-on-one attention and small group discussions than during other orientation training sessions. This seemed to correspond with teacher perceptions. Teacher 4 shared:

He [science coordinator] said, "Sure, sure I'll get you guys compensated and stuff." We met here at School X [pseudonym] one day in the computer lab and just knocked out a bunch of things like pre-tests, and different activities, different assessments. So that, to me, was time well spent within that activity.

Much of the interview data addressed positive aspects of support systems for new teachers, although some problems were noted. While some of the concerns related to support systems, typically, the concerns addressed the role of building-level leadership and ineffective teamwork and school climate issues.

Those teachers who did not feel supported did not speak of strong relationships with co-workers or teammates. Those teachers who seemed less supported spoke of job-alike teams not meeting as scheduled, or that teammates took ideas and asked for copies without mutual sharing or collaborating. This perception of poor group dynamics in job-alike teams seemed to be much more the exception than the rule. But Teacher 9 said:

It [job-alike relationship] was kind of strange because I had a binder from the previous teacher and not knowing what any of that was, he would just assume I had it [a lesson plan] so I knew what to do. So I think that was a part of it. Not realizing that I wouldn't understand what some of those things were. And I tease him about it, if I don't ask the right questions, I don't get the answers that I need. And that, I like to do things so far ahead too and I don't think he does necessarily. That type of work [collaboration] is very different than what I've been used to, too [at the elementary level].

Teachers found that most building administrators had little science content knowledge while trying to lead the monthly half-day vertical team science meetings on staff development days. These administrators tended to focus less on science content and more on state test scores or other non-science district initiatives that teachers perceived as not useful for improving their science instruction. Teachers complained that leadership often provided mixed messages on what type of instructional strategies science teachers should be emphasizing. Reportedly, leadership often asked science teachers to focus on state test prep questions, literacy and writing comprehension skills, and other strategies or initiatives which science teachers said conflicted with some of their current instructional methods. Teachers found themselves pushing their own curriculum to the side, or slowing down the pace at which they felt they needed to go to get through their science curriculum, in order to accommodate the priorities and expectations of building administrators. Teacher 4 said:

Well, they...you do get time [for science professional development on staff development days], but it is always usually about [Midwest's school improvement

plan]. It is typically, I mean, it is a professional development day. Your department gets together, but typically the administration wants you to work on X, Y, or Z at that point in time. You know, you look at the common...the process skills assessments, so you look at stuff like that. So to me, that is just more data interpretation, which is, I guess, a form of professional development. But the value of that, in my opinion, is somewhat lacking. But it is just paperwork that needs to get done.

Finally, teachers commented that leadership did not follow-up or provide enough feedback on their science professional development and instructional methods. Teachers felt they were guessing on expectations for the amount of implementation, the frequency with which district and science initiatives should be incorporated into their science lessons, and how to balance that with other initiatives being pushed by building administrators. Teacher 1 commented:

They have us turn in assignments and stuff. Then it becomes an assignment you have to do while you're teaching and you do it, and sometimes I try to make it connect. Oh, I'll use this in the spring. Well one thing I forgot I'd even made and I've already taught it. Then the [professional development products], it's almost like you make it for them [administration and trainers] and I just wrote that on the survey we took. I think there is [follow-up], but there is not guidance and I don't know. I guess I feel a little bit like...there are all these people that already have the stuff we are doing, and I just feel that they are just kind of like, well if you do [implementation] that's fine, and if you don't do it, don't tell us that you're not doing it kind of thing.

District administrators mentioned that follow-up and feedback were issues and that the district is leaning towards the hiring of additional staff as instructional coaches who should improve quality control by ensuring implementation of science and district initiatives. One district administrator said they currently rely primarily on the skill and knowledge of building-level leadership to ensure new science teachers are properly supported within their teams. Administrator 5 added:

Assuming you really want change to occur, you almost have to go in and see that change. And be there side by side with the teacher to kind of analyze how did that go for you? Where do we go from here? Those kinds of things...We talked about the coaching [instructional coaches]. I think the bottom line is that is the best way to do it [teacher feedback].

It seemed, then, that both teachers and administrators saw a need for building-level administrators to provide follow-up for new teachers, even when the learning communities model was in place. This follow-up may help a new teacher who is flailing among an unsupportive team to feel more secure.

Summary of Perceptions of Midwest's Science-Specific Professional Development

To summarize, new teachers indicated strong interest in opportunities to meet and collaborate with other grade-level teachers from other school buildings, not only to learn more in-depth content knowledge, but also to share lab and assessment ideas. Midwest's middle school schedule allowed this type of science-specific collaboration to occur two or three times a week. This occurred in job-alike teams, or groups of teachers of the same subject and grade level working at the same school building. Science teachers perceived

this type of informal job-embedded collaboration to be ideal for learning, changing their teaching practices, and building relationships.

Analysis of interview, documentary, and observation data revealed that leadership often incorrectly assumed that new teachers had the necessary content knowledge when they began the job, and that additional content workshops at the middle school level were not needed. Teachers expressed a desire for leadership to perform some sort of needs-assessment, through which this misconception could be revealed. But at the time of this study, either Midwest teachers self-identified for assistance, or building-level principals needed to identify science teachers who needed more science specific training.

During interviews, teachers and administrators made many positive comments about the energetic and dedicated district science coordinators. However, teachers and administrators were concerned about the communication with, and expectations set by, district-level leadership. Teachers felt that some expectations from the science coordinator conflicted with what building-level leadership promoted. Teachers felt that they were being pulled in three directions: expectations of general district initiatives, building-level priorities based primarily on state test scores, and initiatives coming from the science coordinators' office. Teachers said that, at times, these three messages were different and the mixed signals were confusing. New teachers had difficulty prioritizing work that should occur during science professional development time during job-alike time, half-days, and staff development days.

Perceptions of Midwest's Barriers to Implementation

Some interview responses fell under the category of Barriers to Implementation. Within this category, interview responses were further divided into three subcategories

that discuss: (a) perceptions of *context and resource barriers*, (b) perceptions of *content barriers*, and (c) perceptions of *leadership and delivery barriers*.

New middle school science teachers and district administrators were directly asked for their perceptions of what barriers and roadblocks keep new teachers from implementing new ideas and district initiatives into their lessons. Understanding both the perceptions of what obstacles stood in the way of acquiring the necessary knowledge, and the perceptions of how leadership supported new teachers in making changes in the classroom were important to answering the dissertation's research questions.

Understanding barriers to implementation also helped me connect how those barriers appeared across categories of induction, mentoring, and science professional development. The intent of this category is to specifically identify issues in delivery, learning, and leadership. While data in previous categories may have indirectly touched on some issues and concerns, data in this category directly addresses the perceived barriers. Specific examples of the overarching issues new teachers face when trying to learn new information and implementing changes into lessons will be given.

Perceptions of Context and Resource Barriers

Context and resource barriers refer to the climate and atmosphere through which teachers navigate in their new jobs. Context barriers may refer to physical conditions or psychological factors that surround the new teacher, and these perceived barriers can help explain why new teachers perceive professional development as effective or ineffective. Discussing context barriers should help with understanding new teacher relationship issues, school climate factors, and team dynamics. New middle school science teachers found several context barriers that limited their implementation of district and science

teaching initiatives. Perceived barriers included time, classroom inexperience, and an overwhelmed feeling.

The context barrier of time was repeatedly mentioned by new middle school science teachers as a reason why science professional development topics, such as inquiry lessons, are sometimes not fully implemented. Time concerns were explained by teachers in various ways, including: not enough time to collaborate, no time to plan and implement changes into lessons, no follow-up time provided for feedback, not enough instructional time to cover the entire curriculum, no time in their personal lives to attend summer workshops to gain ideas or increase content knowledge. Teacher 4 described this lack of time:

I'll give you a perfect example: inquiry based learning. Let kids construct their own knowledge, let them find out. That is a great thing, but that is a time sucker! So if you have this huge curriculum that you are getting through, you might be able to do maybe once, maybe twice a year...I don't think there is time. We are not even getting, I am not even getting through the curriculum that I have.

New teachers often mentioned lack of actual classroom experience as a context barrier to effective implementation of district and science initiatives. Teachers felt that much of their initial training experiences were not useful because teachers had no prior experience from which to draw an understanding of how to modify their teaching and instruction.

A perceived feeling of isolation was another context barrier to implementing professional development training. Some new middle school teachers did not make

personal connections and bonds, or did not feel supported. Teachers said that some job-alike partners did not extend a warm welcome, or did not collaborate and share ideas.

Another commonly noted context barrier was the feeling of being overwhelmed with high expectations to do everything well all at once. This overwhelmed feeling typically began during orientation week and seemed to continue for most teachers during their first few years. During observations, I overheard new teachers discussing not having their rooms or lesson plans ready but they were sitting in training sessions for hours listening to the many expectations of curricular documents and district teaching initiatives. District administrators concurred that many new teachers are just overwhelmed. As Administrator 2 said:

When that reality hits, the overwhelming responsibilities of being a teacher, and the grading and the curriculum, and you add Midwest to that, and Midwest has even higher accountability for a new teacher than some other places. Sometimes that perception [new teacher's meeting expectations] then becomes a dismal reality and they are not able to keep up.

Another context barrier that was brought forward by several middle school science teachers was difficulty understanding middle school students. This centered on building relationships with students, understanding the needs of students with special needs who have Individualized Education Plans, learning how to deal with complex home and social issues, understanding how students in various stages of cognition learn science concepts, and dealing with frustrating classroom management issues. Teacher 9 stated:

I just feel like I'm spread so thin on trying to get everything, where you don't feel like you do one thing right... There is just so much [student needs] that you are responsible for and it is almost like, now you are responsible for teaching them their manners and you're teaching them all these things where, you know, that should happen at home. And the responsibility is on the schools to make sure everybody eats right, making sure, and I know I'm getting off, but it is almost like they get the schools to be responsible for all the traits that these kids are showing up with.

All interview participants expressed that some form of context or resource barrier has held new teachers back from fully implementing district initiatives and professional development training during their first few years. The perceptions of high expectations, not having enough time, not having adequate experience or knowledge, a feeling of isolation, and budget restrictions each seemed to be legitimate issues with which new teachers dealt in Midwest. District-level leadership in Midwest seemed aware of these context barriers. Therefore, the relationship and support between new teachers and their mentors, teams, and administrators were the primary resource and means of intervention to ensure that context barriers did not completely overwhelm new teachers to the point that they did not learn or make progress through district-sponsored professional development.

Perceptions of Content Barriers

Content barriers refer to the science-specific curriculum and content knowledge that teachers are expected to deliver to students. Content barriers can also refer to the curriculum and district initiatives that new teachers are expected to learn and implement

in their classrooms. In this section, use of the term content refers both to what is being taught in professional development activities and what is being taught to students in science classes.

New middle school science teachers expressed not being familiar with some units within their own curriculum because either they had forgotten undergraduate training on those concepts, or they were so far removed from learning the content that they needed to relearn the material. Teachers stated that they learned or relearned their science content primarily by self-teaching, reading their curriculum materials, doing internet searches, or attending out-of-district courses. Teacher 2 shared:

I'm focusing so much on science and have not had a [college] science class in 6 or 7 years probably. It has made me do a lot of research for myself using reference books, using our book. A lot of planning goes into my days now, due to the fact that I'm learning a whole new curriculum...I would like to look into taking some college classes just...for my own [content] learning.

Teachers overwhelmingly desired more opportunities to discuss content with other science teachers in the district and more district-sponsored content-specific professional development during the school year and summer. Teachers felt that the district offered little to no formal science content training that would help increase their basic science knowledge. New teachers were open to the idea of additional formal and informal professional development that would focus on their specific curriculum content.

New middle school science teachers said that placing brand new science teachers on the district's science curriculum committee was not desirable or ideal, yet it seemed to

occur. New teachers said they felt inadequate to make judgment calls for the entire district because of their lack of experience with the curriculum. Teacher 3 explained:

I was on the curriculum committee for a year, so we met maybe 12 times that year...I think it was bad that I was so new when I did it because it was difficult for me to stand up for anything or really have an opinion about anything.

Interestingly, district administrators did not perceive content at the middle school level as being a major barrier for new teachers. Most of the interview responses regarding science content issues led to discussions of elementary and high school science teachers and not middle school teachers. District administrators seemed more concerned about hiring teachers who have talent in the profession. District administration explained this talent as showing student empathy and compassion more than a teacher being an expert in their content area. Administrator 2 said:

Our district has all new teachers to the district take the Gallup Perceiver Instrument. It is called the fifth survey. It is a survey that Gallup research shows that a teacher who scores at a certain caliber...on the survey will be successful in the classroom...It [new teacher's success] is not about content knowledge, because we feel like they can learn that. If they have their degree, they should have learned that. In a content area like science...we figure if they have the degree, they have passed the standards that the college and the content area require in order to teach science...They need to have, and it seems like that is a given, but the Gallup questions are such that they get at that level of compassion, and empathy for teaching kids.

Administrators were more concerned with making sure science teachers deliver the curriculum encouraging higher level thinking skills and strategies, using technology, and improving student achievement. District administration believed middle school teachers will seek out help in content if needed, or building administration will ask for support for individual teachers if a content concern is identified.

When compared to perceived context and resource barriers, the perceived content barriers that surrounded a new teacher's experience were less of a concern for new middle school teachers and district administrators. When directly asked if content training was a problem, several new middle school science teachers expressed a desire for a refresher course on several curriculum topics. Teachers shared that Midwest currently offered little formal content training during professional development offerings. Teachers expressed interest in content training if new courses or trainings were offered.

Perceptions of Leadership and Delivery Barriers

Leadership barriers refer to how well teachers perceived that administrators supported them with professional development and district initiatives. Leadership and delivery barriers can also refer to how professional development trainers and administrators chose to structure and teach professional development sessions. Interview data revealed some positive aspects of leadership, particularly the role of the district science coordinator. Concerns were noted, though, with leadership's communication and follow-up with teachers.

Teachers spoke of the district's science coordinators as positive and supporting their needs. Teachers thought the science coordinators' resources were accessible and that it was common for them to put on individual and group trainings, when requested. Only a

few teachers commented on feeling supported by supervising principals' feedback on how they did with implementing science curriculum.

New middle school science teachers perceived that one of the least effective aspects of leadership was an overall lack of communication regarding professional development expectations. Teachers said that building administration gave mixed messages on the priority of and timeline for initiatives and teaching methods being implemented. Teachers said that building administrators often did not explain to them why an initiative was needed, how it came about, or why it had been implemented district wide. Teacher 3 communicated:

You know, in business when you decide that you want to implement something in a facility, you have to prove it has value and that it has been successful somewhere else and why you think it will be successful here. And so when you want me to implement a certain philosophy [initiative] then please persuade me. Please don't treat me like I don't have a brain and I am just going to do as you say because I am an employee. Sell me on it.

Teachers mentioned that administrators and professional development trainers did not seem competent in understanding many of the new ideas being introduced during training sessions. Almost all teachers agreed that principals and trainers did not have a clear understanding of why many new initiatives were needed, nor did they have a timeline for when and how to implement the new ideas and initiatives. Teacher 6, who just finished explaining how hectic his personal life was, then commented on frustrations with formal district professional development training adding to his stress:

Terrible follow-up. This is going back to last year, we had a professional development topic, how do you use and tape record yourself so that if you are out for the last period, instead of a sub, you could put it up to the board and they can show it? Do we even have that program? No. We don't even have it yet! What the hell are you even showing it to me if we don't have it yet! I can't believe you took an hour and a half of my time.

Teachers reported that administrators and trainers introduced too many initiatives in a given school year with little to no follow-up. Teachers said administrators and trainers often did not follow-up, observe, evaluate, or provide feedback on a teacher's actual implementation of professional development ideas and district initiatives into lessons. Teachers thought that their evaluating principals provided little, if any, beneficial science content feedback during evaluations. They found the evaluation instrument itself to be confusing and of little help for modifying their science content delivery to students. Teacher 4 articulated this:

There is a follow-up? (ha, ha,) I mean...is there any follow-up? I mean...you know, I think that you have whoever your administrator is coming in and observing in your class, but I don't know if there is any specific follow-up, per se, by the people who are actually delivering the training.

On the rare occasion that teachers perceived professional development sessions as involving teachers producing a usable product, some teachers said those products felt contrived to satisfy the requirement of the training. Therefore, they did not get incorporated into lessons, yet trainers likely assumed those products were being implemented. Furthermore, because teachers said there was little feedback, no one

seemed to be checking if and how often all the new strategies were used and implemented after training sessions.

Interestingly, while teachers spoke of leadership and delivery barriers, many new middle school science teachers reiterated that the learning communities model of professional development was the most effective delivery method because it allowed for teacher collaboration, time to plan lessons, and choices of learning topics. Teachers thought professional development training was delivered well when it provided and modeled examples for how students would actually use and work with hands-on labs. Teachers felt that the district supported new teachers in finding out-of-district professional development and provided financial support to attend those courses.

Concerns existed regarding some of the delivery methods used by leadership and trainers for formal professional development. Teachers shared that most of the formal training sessions had too much information in lecture format and that it was not relevant to their science curriculum. The large group formal professional development workshops and sessions provided teachers with little ownership of the topics and little collaboration time to work time with other teachers.

District administration perceived only some middle school buildings as being ideal learning communities. But those administrators believed that job-embedded professional development opportunities that allow for teacher collaboration and teachers to take ownership of their learning was the most desirable form of adult learning that the district offers to teachers. District administrators perceived a lack of vision and direction from the district level that allowed building-level leadership to vary in their implementation and interpretation of learning communities as the primary form of

professional development offered to teachers. District administrators realized their communication and expectations could be improved so that teachers and building administrators received clearer messages on district initiatives. District administrators estimated about half the middle school buildings in the district have interpreted and implemented the learning communities model with success. The other buildings were noted to have leadership and climate issues, and perhaps inadequate training to help principals interpret how learning communities should be implemented. Administrator 3 revealed:

It is not a deficiency on the building part. It is more a lack of direction on us at the district level to say, here is the district's vision of a learning community. Great, you can go listen to DuFour, da, da, da. But here is what we believe based on the newest research on learning communities what it should look like, here is the expectation for it. Then, here it is, principals. Let's train you on it and you go forth and you go work with your staff on it. Nothing about building principals [lack of leadership capacity], it is just what we [district administration] have done. We have let everybody go random mandy pandy out there and let them do whatever they want. And some people have read the research correctly and some people have gone to great trainings outside the district, it has been great. But this has not always occurred. And we have yet to do a training. If you would look back on the administrative professional development plan, we have never done a workshop on learning communities from our district staff to building principals. Can you imagine?!

Administrators expressed that long range planning, quality control, and accountability for professional development were very difficult to tackle, given the amount of time, resources, and other responsibilities placed on their shoulders in a large school district like Midwest. District administrators wanted to see a clearer, unified message communicated to principals regarding how professional development should be designed and implemented at the building level. District administration desired more accountability at the building level to ensure that professional development was delivered in a job-embedded manner rather than with lecture and rote activities.

District-level leadership in Midwest had the expectation for all middle school buildings to set up learning communities as the primary form of professional development for new middle school science teachers, and for all teachers. When principals interpreted the research on learning communities appropriately by establishing supportive teaming, collaboration, and teacher ownership, teachers reported having more positive experiences and feeling more supported than teachers in buildings where the learning communities model was not functioning properly. New middle school science teachers generally agreed that leadership had too many ill-communicated initiatives happening at one time. Initiative vision, goals, and timelines were not always understood by teachers. Teachers reported issues with large group formal trainings which fell short of meeting the needs of adult learners and making connections to their science curriculum. Furthermore, if new initiatives were delivered outside the framework of the learning communities model of professional development, new teachers felt leadership and professional development trainers provided little to no feedback or follow-up after initial training on most district initiatives.

Summary of Perceptions of Midwest's Barriers to Implementation

To summarize, teachers were overwhelmed with the high expectations of Midwest School District and with district leaders' frequent proposal of new initiatives. Building administrators seemed unwilling, unable, or perhaps untrained to follow-up on all of the new goals and initiatives. This lack of follow-up and communication by district and building leaders often left new teachers with many questions. They wondered what initiative to implement, if they were implementing an initiative correctly, how often to implement, and whether or not an initiative made a positive impact. District administrators agreed that the long-range planning and accountability of professional development were very difficult in a large district, such as Midwest.

Additionally, teachers' lack of experience often hindered them from taking new ideas from training sessions and collaborating with others to make the training relevant. New teachers also admitted that the actual curriculum content was difficult and they desired more time to deepen their basic science content learning and knowledge.

Some of the most interesting findings came from new middle school science teachers' perceptions of leadership ineffectiveness in delivering certain aspects of professional development. Teachers praised the collaboration that occurred in their weekly informal site-based learning communities. But teachers believed they gained little from the formal large group training sessions which were delivered with direct instruction.

Perceptions of Adult Learning in Midwest

Some interview responses fell under the category of perceptions of adult learning that occurs in Midwest School District. This section will present new middle school

science teachers' and district administrators' perceptions of the types of adult learning that new teachers experience during professional development opportunities in Midwest. The category was divided into four sections: (a) perceptions of the role played by *transformational learning* in professional development, (b) perceptions of the role played by *informal/incidental/assimilative learning* in professional development, (c) perceptions of the role played by *learning communities* in professional development, and (d) perceptions of the role played by *direct instruction/concrete knowledge* in professional development. Findings in the first two sections speak to perceptions of the theoretical types of adult learning that teachers may experience. The last two sections speak to perceptions of the delivery methods used when providing and supporting adult learning.

Perceptions of Transformational Learning

This section will discuss interview findings that related to transformational learning, which suggests that teachers learn new information through a process of socially constructing meaning. This happens when teachers allow others' perspectives to help change their current understanding of the world. This learning is said to be transformational because teachers will then change their own views on issues and may make changes based on those newly acquired, socially-constructed world views that are accepted as new norms for them.

When discussing their professional development experiences in Midwest, new middle school science teachers often described the variables and conditions associated with transformational learning. Teachers discussed how being open to other people's viewpoints and interpretations helped them make sense of their reality. New teachers stated that they had professional development that informed their practice and allowed

them to modify and change their practice because they heard and saw other ideas. For example, Teacher 2 said:

I have no problems sitting there listening to other people's aspects and how they look at things and say hey, maybe I could do that for a day. And show the kids that there is a different way to look at things. So I definitely think especially the personalities that go on with things like that, you are definitely going to get many different opinions.

Teachers said that professional development trainers often encouraged teachers to share their experiences and problems. Then, others helped to analyze and discuss alternative viewpoints. According to Teacher 4:

What happened was, we asked Jerry [pseudonym, science coordinator], "Hey, can we meet together? We want to work on some units and activities for sixth-grade science." So he said, "Sure, sure. I'll get you guys compensated and stuff." I think you always want to find out what other people are doing, and the complexity of, or how deep they are teaching. And so that makes you think, maybe I should have hit that area a little bit harder, and so I think that there is always reflection on that, when you hear different teachers doing different things.

New teachers stated that professional development in Midwest helped them self-reflect and see problems and dilemmas in their current teaching. They reported that this prompted them to seek out mentors and other teachers with whom to collaborate and help solve those dilemmas. Most teachers commented that they socially-constructed new ideas and solutions to problems, particularly when meeting with their grade-level team or other science teachers, and they were able to see other perspectives when collaborating.

A few teachers directly stated that they thought formal district professional development did not challenge their current teaching methods or disturb their current philosophies and thinking. Teacher 10 stated:

I don't feel that any of that [professional development training] was challenging because I don't know if it was so recent, that I just had everything [undergraduate degree] and it is not like I was old school and entrenched in my ways and know they are coming out with something new.

Yet these teachers did report that they picked up some new ideas by collaborating with others during informal professional development sessions. Teacher 10 added:

I would say, most of it eye-opening, like "Oh I never thought about it that way." I don't think it changes what my core believes are and what I want to ultimately accomplish in my classroom, but I think it may be like, "Oh I could try that."

District administration seemed familiar with the term transformational learning, and acknowledged that it is a valid concept they try to incorporate in the planning and delivery of district professional development. District administrators perceived that a lack of quality control in the implementation of learning communities or a lack of a unified accountability system for all the buildings in this large district helped explain why transformational learning did not occur for all teachers. Administrator 3 shared that:

I think that one of the things at the district level we are trying to be more purposefully focused on is the relationship and the strands between the various components of professional development. So that no matter what we are doing the goal of professional development is to increase student achievement...It is talking about having a common vocabulary about professional learning

communities...What did you accomplish, what did those people [teachers] learn?

Being much tighter on our [professional development trainers'] own teaching.

District administration spoke of the structures and conditions that must be put in place for adult learners to socially-construct knowledge and learning. Administrators believed job-embedded teacher collaboration is the key to teacher learning. Administrator 2 said:

I feel strongly that the most useful staff development...is where a teacher is working with another teacher in a learning community situation. You have a group of teachers teaching the same content and they are sharing their best practices, they are sharing their assessments, they are planning units together.

That is to me the highest form of professional learning, and it is where teachers learn the most.

The interview data suggested that transformational learning was perceived to happen in Midwest under certain conditions. Socially-constructed learning seemed to occur when teachers were put into groups of similar interest, grade-level curriculum, middle school teams, and other learning community groups. The data suggested that Midwest's formal large group activities offered little opportunity for socially-constructed learning and were perceived by teachers as more of a review of undergraduate classes.

Perceptions of Informal/Incidental/Assimilative Learning

This section explains that some teachers perceived their learning not as a socially-constructed activity, but rather, as being shaped by the context in which one finds oneself. Assimilative learning can occur when teachers are introduced to a new culture, whether it is the culture of being a professional teacher or the culture of a new district and

school setting. The research on these types of adult learning assumes that teachers do learn during their first few years of teaching, and that learning might be just a natural result of gaining more classroom and life experience (Marsick & Watkins, 2001). This learning is based on informal observations and casual conversations pieced together, without a formal training and without being socially-constructed.

Some new middle school science teachers perceived they had learned more from experience during their first years of teaching than by having their paradigms challenged by other viewpoints. Some teachers described learning by trial and error experience as they assimilated into the culture of the schools and gradually learned how things were done. When asked how he learned best, Teacher 3 commented:

I am a hands-on person. I like to do things and touch things and push stuff around and get dirty, and that is how I teach my class. Some people are not like that, so don't teach like that. I mean that is my philosophy in general [on how I learn best].

A few teachers commented that they were simply not ready to learn through transformational learning during those first years because they were just keeping their heads above water and gaining experience. Teacher 9 shared that “the longer you teach, it is like, you seek out the ones [workshops] that will help you.” Teachers expressed that after some time had elapsed beyond the first year, they could transform their perceptions based on collaborative professional development sessions. In the meantime, though, new learning often occurred just by doing—through experience. One district administrator perceived that adult learners are more receptive to learning and change when they have about 5 to 10 years of teaching experience. Administrator 2 said:

I just saw a study put out by the National Staff Development Council... a study was done that was measuring whether or not if teachers in their first years were more receptive, open, willing, conducive to change, and what not. And they [researchers] found that it was actually teachers in their 5th through their 12th year of teaching who were more open to learning and attending workshops and changing their teaching strategies... Teachers in their first few years are trying to just get their feet on the ground with classroom management and know the curriculum.

While ongoing experience certainly yielded new learning during the first few years, new middle school science teachers had other sources. A few teachers commented that during the first few years, they learned new information by reviewing college textbooks or searching the internet. Informal discussions with colleagues also helped new teachers navigate the new culture in which they found themselves. When asked through what means he learned other than professional development sessions, Teacher 3 stated:

It's through graduate work, it is through undergraduate work... If there is something I don't know, I can go and look it up. I do spend a lot of time looking around for new stuff and new ways to do different labs or different ways to do something. I spend a lot of time doing that. And if there is something I don't understand I go and figure out what it is or go ask somebody. I'm not afraid to go look in a college textbook.

New science teachers who went on the district's summer field trips perceived they learned new ideas and gained a deeper understanding of curriculum because they

immersed themselves into the field experience and experienced it hands-on. Teacher 2 shared:

I think I learned a lot in just walking around and working with a specific instructor, and those instructors live up there. Some of them, all of them, are in like their graduate school, and they are in Biology, or Environmental science...Just walking around with that kind of person and sitting there listening to him...I would learn a lot right there.

New middle school science teachers and district administrators in Midwest realized that brand new teachers often learned simply by gaining classroom experience, reviewing college textbooks and material, trial and error, and being immersed into a new culture during their initial teaching years. Interview data suggested that these methods were how some new teachers perceived they learned the most during their first years in Midwest. Teachers and administrators expressed that many new teachers were more comfortable with socially-constructed learning after 2 or 3 years of experience under their belt.

Perceptions of Learning Communities

This section on learning communities discusses teacher and administrator perceptions on how effectively the learning communities model of professional development is delivered to new middle school teachers in Midwest School District. The section includes perceptions of how learning communities are organized and structured, and what activities are considered the most beneficial in supporting teachers' learning and implementation of new ideas and district initiatives.

Midwest's new middle school science teachers described the learning communities model of professional development as a collaborative way to promote socially-constructed knowledge. New teachers reported having weekly plan time with grade-level team members, as well as weekly plan time with their job-alike team on science-specific curriculum. Teachers also stated that on half-day staff development time, they experienced learning communities because they chose which session to attend and a teacher from the building would often lead those discussions. All teachers agreed that the informal professional development time spent with their job-alike partners seemed to be the most desirable and useful. In the interviews, some teachers actually used the term, learning communities. Some referred to PLOs, or Personal Learning Opportunities. Other teachers described the structure and concept behind learning communities without using the specific term.

New middle school science teachers felt that support from the district science coordinators' office, along with attendance at summer workshops and field trips organized by the district science coordinators, provided teachers with another learning community with which to collaborate and receive support. Teachers stated that the science coordinators encouraged gathering groups of science teachers from multiple buildings, both during the school year and summer, to work on common curriculum, assessments, lab ideas, and district initiatives. Some teachers said that they continued to meet with teachers from other buildings, some even off the clock, by self-organizing meetings on weekends or during summer break. They enjoyed each other's support and valued the ideas gained when collaborating. Teacher 11 discussed:

And we have continued that [collaboration] on our own. Four, let's see, five of the seventh-grade earth science teachers, we just met on our own two days last summer and that was more helpful than anything we have done. We just shared great ideas. And we didn't get paid or anything.

During interviews, district administrators explained the concept of learning communities as an ideal form of professional development. They believed that middle schools in Midwest were trying to implement that concept. District administrators believed the best way to provide teachers with ownership for managing their own learning was teacher collaboration through ongoing job-embedded work. Administrator 3 stated that "I think they [teachers] learn best from each other...I would always have other people with me [organizing training sessions] that are in that content area, because they learn best from each other to talk specifically in the content area."

However, district administrators perceived that only some of the middle school buildings were effectively delivering the learning communities model to teachers. Some buildings were perceived to be struggling with implementation either due to a lack of training for and communication with building principals or because of weak building leadership. There was also a perception that those buildings had developed lower teacher morale because of group dynamic issues and a negative school climate. Administrator 2 shared:

What is happening now in a lot of cases is that, at school sites, people meet on early release days, they meet in collaborative teams, but they are just going through rote activities more like a business meeting. And the learning, actual new

learning where you might change your practice or think differently about something related to your content area, doesn't, isn't happening.

Interview data related to learning communities found those middle schools in Midwest with perceived strong leadership, positive school climate, and appropriate organization of professional development activities to be ideal locations for new middle school science teachers to learn and share ideas with one another. New teachers were also supported by Midwest's science coordinators through summer workshops, fieldtrips, and science initiatives throughout the school year. Less effective were those middle schools with perceived poor school climate and weak leadership. These middle schools were perceived to lack the foundation to allow teachers to truly share ideas. These schools were viewed as merely going through the motions of learning communities.

Perceptions of Direct Instruction

This section presents teacher and administrator perceptions on professional development that is delivered via formal large group presentations. Direct instruction refers to information that is passed on typically by one speaker, who primarily delivers all the information without teacher engagement or input. Direct instruction is often accompanied by a PowerPoint presentation or a printed outline of the lecture from which the presenter rarely deviates. This section reports on the amount and frequency of such professional development trainings.

Most new middle school teachers believed the least effective delivery of professional development is a formal lecture providing large amounts of information. All teachers said they have experienced professional development lectures where someone read straight from a PowerPoint without deviation or elaboration on information at some

point in Midwest's professional development trainings. Teachers found that too much information was provided in a small amount of time during those lecture sessions. They perceived the information to be redundant or irrelevant, and it provided no examples for implementation. Many of the topics covered in the formal professional development sessions were just recently covered during their bachelor or master degree programs. Teachers believed that most lecture-style professional development did not model how to deliver initiatives to students. The lectures seemed more theoretical than practical for teachers. Teachers thought that direct instruction did occur in Midwest from time to time. Teacher 1 said that:

The other ones [not teacher collaboration] are usually a lecture with a PowerPoint. And every now and then, it depends, it depends on who the lecturer is, sometimes I like that, to hear them tell me here is what I know. But some of them are, I don't mind a lecture, but if you sit there and read off the PowerPoint, then I usually hate it and, so those kind of things I don't like.

Teachers pointed out that direct instruction seemed to be used more often during new teacher induction week and general teacher orientation week. Teachers perceived that these lectures were designed more for meeting the requirements of local and state accountability standards than for teacher learning. Teachers also perceived that most of these direct lectures were annually required for legal, liability, or state accreditation purposes. They perceived, therefore, that these trainings were something they just had to sit through; seemingly a right-of-passage of being a public school teacher. Teacher 9 articulated this:

I think just being handed something, or being given like a huge binder and you know, this is the information that you need, or you have to teach all this. I think that it just turns you off because you're like, there are so many other things that you need to be working on and it is overwhelming...Some of that information I think sometimes they just try to go through it real quick.

District administrators explained that Midwest was trying to move away from direct instruction, but said it does occur at times depending on the context and content of information being delivered to teachers. Administrators agreed that direct instruction was the primary delivery method during orientation week, but that the district was working to introduce a variety of teaching methods to help break up the multiple sessions new teachers must attend. Administrator 1 said:

They [professional development trainers] do PowerPoint and group work. The only thing I can say is that, and there is not an easy way to fix it [orientation training], the big groups are often of unlike people, so it is impossible for them [trainers] to have every example be science or examples be language arts.

Therefore, during the examples that are not relevant to them, the teachers are turning it off.

Administrators expressed that orientation week has improved over the years, but was still not an ideal learning environment for adult learners. Administrators shared that during the school year, a majority of the district's professional development occurred at the building level, and that it was not delivered with direct instruction or lecture format as frequently as at other formal district trainings.

Although direct instruction was not preferred by most teachers, two teachers did report desiring direct instruction over other delivery methods because they wanted the information as quickly as possible. This then allowed them time to go back to the classroom and work on implementing the information into their lessons. These teachers said they learned best with direct instruction and did not have a problem with trainers who delivered information in that format. Teacher 5 mentioned:

If you're going to talk to me about philosophical management of a classroom, or brain development or hierarchy of questions, don't make me do pretty colors on a flip chart, share with teams, and stuff like that. Just feed it to me. Better yet, just send it to me in an e-mail and trust me.

Direct instruction did occur in Midwest as a way to deliver necessary information to teachers. New teacher orientation week used this delivery method, as did the annual orientation for all teachers. During interviews, new middle school science teachers and district administrators in Midwest did not seem distressed about direct instruction occurring during the course of the regular school year during professional development opportunities. Teachers and administrators reported that it was unlikely that the district would or should totally eliminate the use of direct instruction because of the large amount of material that must be conveyed in short time frames each school year.

Summary of Perceptions of Adult Learning in Midwest

In summary, most teacher comments regarding adult learning styles were related to the delivery method used by professional development trainers. For the most part, teachers said that formal, large group professional development occurred during induction week, and that it was the least effective delivery method. This format was

branded as redundant, not relevant to science, or as providing no opportunity for collaborative work. Conversely, teachers also described informal, job-embedded professional development that occurred on a weekly basis as providing them with the structure, time, and support to make useable products and changes to their lessons. So, one could make the argument that teachers in the learning communities model of professional development were provided ideal situations for adult learning to occur.

By participating in the learning communities model of professional development, teachers experienced transformational learning. This model allowed opportunities for teachers to make socially-constructed meaning of district initiatives and science strategies. Within the learning communities model, teachers often had conversations and discussions that were eye-opening and perhaps provided a disturbing dilemma to their current paradigm. At times, new middle school teachers' transformational learning was limited because of barriers already discussed, such as leadership support, relationships with job-alike partners and mentors, and reflection time.

The type and effectiveness of adult learning that actually occurred went hand in hand with the structure and context of the specific professional learning situation. For example, when relationships were positive and teachers were allowed to work on teams that informally set their own goals and agendas, the type of learning promoted by the district was perceived to be more effective. Conversely, when teachers felt more isolated, they often said that the most effective professional development occurred outside the district at conferences or in their graduate degree programs. So, even when new middle school teachers were placed into learning communities, if positive relationships were not present, the teachers reported learning that was not transformational in nature. Therefore,

to experience true transformational learning, new middle school science teachers needed a combination of factors: supportive leadership, positive relationships, opportunities for collaborative work, and consistent follow-up.

CHAPTER FIVE: INTERPRETATIONS, IMPLICATIONS, AND CONCLUSIONS

Introduction

In Chapter Four, five major categories emerged from the data collected through 17 interviews with Midwest School District administrators and new middle school science teachers. As Chapter Three's description of research methodology mentioned, these categories were also developed through triangulation of multiple data sources, including observations of seven new teacher professional development sessions and analysis of nine district documents. Chapter Two elaborated on what is already known about high-quality professional development, adult learning, and issues facing new science teachers. The purpose of Chapter Five is to make connections, both across findings from the five major categories, and as the findings relate to educational research literature.

Chapter Five will first address the four research questions that guided this study. Then, I will provide interpretation of the findings by highlighting three major themes that emerged during data analysis and that spoke to the study's research questions. These key themes were: (a) leadership, (b) relationships and collaboration, and (c) follow-up and feedback. Chapter Five will make connections between and across the five categories developed in Chapter Four. Finally, Chapter Five will make some conclusions and consider implications for practice.

Addressing the Research Questions

This section will specifically address the study's four research questions. The qualitative nature of this research allowed answers to these research questions to emerge

during data collection and to develop as the findings were reported in Chapter Four. What follows are responses to the research questions. Elaboration and additional details or examples will be shared throughout the discussions in Chapter Five.

What is the extent and content of professional development when training new middle school science teachers in a suburban school district?

Midwest School District demonstrated an extensive array of professional development offerings for new middle school science teachers. During interviews, district administrators revealed that Midwest plans its 3-year new teacher induction program around NSDC standards. District officials were also well-versed on current research-based ideal professional development delivery methods for adult learners. Midwest's two science coordinators' jobs were to help teachers understand and implement the district's science curriculum. They were available to all science teachers for consultation, advice, or resources via e-mail, phone call, or face-to-face meeting. Midwest offered professional development trainings during summers, when teachers may have more time available to learn new concepts or expand current knowledge.

Midwest offered extensive induction training for new teachers, as well as some specific training for new science teachers. New teachers were provided mentors during their first year. Throughout their first 3 years, new teachers participated in pull-out workshops and trainings on curriculum and district initiatives. New teachers were members of building-level teams, and time was provided for weekly planning with those teams. Midwest encouraged the use of professional learning communities. Additionally, Midwest's new middle school science teachers were offered annual reimbursement for continuing education.

The overall structure of orientation week, teaming and collaboration in learning communities, mentorship, and district summer workshops offered new teachers a wide variety of professional and social networks. Midwest appeared to make an effort to invest adequate funds and personnel in the area of professional development for all teachers. Looking at the big picture, I believed that teachers were thankful for Midwest's attempts at providing them multiple types of professional development during their first few years.

One issue related to the extent of new teacher professional development was the sheer amount of topics, initiatives, and goals that were addressed in the course of a new teacher's first few years. Additionally, because the scope of professional development was vast with a large number of teachers in the district, new teachers felt that they had to be very proactive to seek out specific trainings that addressed their individual needs. It seemed that they could not rely on others to necessarily identify their weaknesses. In this study, young new teachers, more than second career new teachers, reported feeling uncomfortable about self-reporting that they needed additional help and support. For example, if a young new teacher's need for more content training in genetics was not recognized by the principal, mentor, or team, then that new teacher needed to independently find a way to bulk up on that learning. Conversely, second career new teachers said they went to the office to ask for more assistance, asked for a different mentor, or frequently called the district's science coordinators. Because of this need to self-report, and other barriers discussed in Chapter Four, such as high expectations, lack of follow-up, and lack of experience, it seemed that the extent to which professional development opportunities were accessed by new middle school science teachers was contingent on the quality of mentorship and guidance of others. These individuals helped

new teachers identify and then access the necessary training to meet the individual needs that varied from teacher to teacher.

New teachers received varied content training during their first years in Midwest. District administrators seemed to rely on undergraduate degree programs to adequately prepare new middle school teachers in their specific science content areas, which in turn allowed Midwest to focus its trainings on classroom management, elements of effective instruction design, differentiation, and assessment practices. Some new teachers said these training sessions were generic or redundant, yet all teachers felt they were required to attend these trainings whether or not they needed them. Teachers wanted more flexibility as well as a pre-assessment of the content they needed in order to meet their individual needs both during induction week and throughout their first years of teaching.

Many new teachers in this study desired more time to learn about science-specific techniques like inquiry labs, or content training on such curriculum as genetics and meteorology. They desired content that was specific to their grade-level curriculum rather than generic lessons. The key issue was not necessarily that Midwest did not offer any science-specific content training. Rather, the issue dealt more with assessing what trainings the new teacher actually needed, delivering those trainings through job-embedded daily collaboration, and ultimately following-up with the new teacher to check on individual progress. New teachers did report few science-specific content trainings offered by the district. But the researcher interpreted other variables—namely leadership, relationships, and follow-up—to more directly impact new teacher progress and learning.

To what extent do new middle school science teachers find district-sponsored, new teacher professional development to be effective?

Teachers and district administrators all agreed that ideal new teacher professional development included quality mentors, collaboration with teams, and learning communities that met weekly. It was clear that the delivery method shaped opinions on effectiveness more than any other factor.

During formal professional development trainings, such as orientation week, most new teachers perceived a disconnect, or gap, between the training and their ability to incorporate that training in the classroom. For example, Midwest highlighted training on curriculum differentiation during the teachers' first few years. But new teachers struggled with implementation because they desired subject-specific modeling on how that should look in a science classroom. Furthermore, new teachers and district administrators agreed that new teachers' general inexperience, lack of professional development reflection time, and being overwhelmed with expectations all contributed to the difficulty of bridging this gap in just a few training sessions sprinkled throughout the school year.

Thankfully, Midwest provided time for daily, weekly, and monthly professional development that was more informal and occurred at the building level. When new science teachers had quality relationships with mentors, team members, and science job-alike partners, they reported the most success understanding and implementing new initiatives. New middle school science teachers reported professional development as helpful when they had opportunities both to observe how concepts like differentiated instruction might look in a science classroom and to have interactive discussions with other science teachers.

For new teachers in Midwest, central to judging the perceived effectiveness of professional development was the expertise and commitment of the community of learners surrounding them at the building level. Did those individuals reach out and make a relationship? Did these individuals help recognize weaknesses? Did they truly discuss issues with the new teachers and then help them reflect on their teaching? Did those individuals follow-up on issues at a later date? Some teachers in this study answered yes to these questions and they reported being happy with the quality and effectiveness of professional development experiences. A few teachers had issues with leadership communication, group dynamics, or experienced personal conflicts that affected their satisfaction with professional development during their first few years in Midwest.

How, and in what ways, do new teachers perceive that their training supports their teaching practices?

New teachers perceived that training supported their teaching practices when they participated in learning communities and job-alike activities. When mentors and colleagues interacted, shared ideas, and planned together with new teachers, those new teachers reported that professional development was more meaningful to daily work experiences. New science teachers reported the most support for their teaching practices when they experienced a strong relationship with another science teacher or science mentor. When these individuals collaborated together on science curriculum, lesson planning, and lab ideas, new teachers reported positive effects on how they taught during their first few years.

New Teachers perceived that they had more ownership of the professional development topics when they worked with job-alike partners and science mentors. This

allowed new teachers to immediately see the relevance of their learning and how to implement ideas in the classroom. In other workshops and formal training sessions, new teachers might have learned great ideas, but did not perceive them as immediately supporting their teaching practice.

Several perceived barriers affected how professional development training supported new teachers' teaching practices. Context barriers that hindered the implementation of some training included the notion that a lack of classroom experience affected new teachers' abilities to make connections and make changes based on district training. Many teachers reported feeling overwhelmed with expectations and receiving a lack of guidance. New teachers may not have acted on or pursued additional training on self-perceived weaknesses. Other barriers included a lack of reflection time and collaboration time to really sit down after trainings to plan out new lessons. Teachers complained that the trainings often did not show them subject-specific examples and left it up to the professionalism of the new teacher to apply the training to their subject and grade level.

Another variable involved the support groups that assist in implementation and feedback after training. New teachers desired others to communicate expectations regarding appropriate implementation of professional development. They also wanted feedback when changes were attempted by new teachers. It appeared that teachers who experienced the support of others, both during and after training, perceived that training did support their teaching practices. New middle school teachers and district administrators in Midwest agreed that additional resources and support are needed to ensure teachers are actually modifying and improving their instruction based on district

trainings. The overarching themes discussed in this chapter provide the reader with details on how influential leadership and feedback were to new teachers' perceptions of support during their first few years.

How can suburban school districts better prepare new middle school science teachers through induction programs (including mentoring) and professional development offerings?

To better prepare new middle school science teacher through induction programs, suburban school districts should incorporate more science-specific examples through a collaborative delivery system while staying away from lengthy, generic direct instruction with large groups of unlike teachers. Furthermore, leadership should clearly communicate expectations for teacher collaboration as well as how frequently changes should be attempted after professional development trainings.

Building principals in Midwest should become more active in ensuring that new teachers are making positive relationships with others in their building. School leaders must focus on assigning strong, grade-level and subject-specific mentors while also looking for ways to expand reflection time and feedback after professional development training has occurred. District and building-level leaders should provide additional mentor training and clarification of mentor expectations. Midwest administrators mentioned the possible addition of instructional coaches. These additional staff members could, in fact, bridge the perceived gap between training and classroom implementation.

Large suburban districts like Midwest must have clear communication with new teachers that does not conflict with other initiatives or overwhelm them with too much information at once. Teachers in this study said that multiple district initiatives and high

expectations to improve several areas of their job pulled them in different directions and confused them. Teachers questioned if they should focus more on getting through the curriculum, incorporating more inquiry lessons and high-level thinking skills, putting more time into reviewing state test prep questions, or pushing kids to be more involved in extra-curricular science clubs. Schools should try to limit the number of new initiatives and pull-out programs that new teachers are involved in during the school year. The implications and conclusions sections of this chapter expand on these thoughts regarding what large suburban school districts can do to help support new middle school science teachers through district-sponsored professional development.

Interpretation of Findings: The Three Major Themes

In the following sections, I will offer multiple examples of the three aforementioned major themes—leadership, relationships/collaboration, and follow-up/feedback—and show how they cut across and affect all five categories of findings. Literature from Chapter Two will support my interpretations of the impact these themes have on the professional development and perceived adult learning of new middle school science teachers. These three themes emerged as overarching factors that seemed to affect new middle school science teachers feeling supported in learning and implementing new information through professional development trainings during the first 5 years of their middle school teaching careers at Midwest School District.

The five categories of findings in Chapter Four developed as a way to organize and interpret the data based on patterns of responses and specific topics. Categories were greatly influenced by the range and scope of interview questions. The three themes were different. They developed as my interpretations of what shaped the overall quality and

experience of new teacher professional development. These themes affected new teacher experiences in at least one aspect of each of the categories. These themes were not necessarily directly stated by interview participants. Rather, they seemed to reflect the essence of what ultimately shaped new teachers' overall experiences with, and perceptions of, quality professional development. The themes built upon ideas expressed in multiple categories.

Leadership

The most significant theme that emerged in data analysis was the role of Midwest's leadership, who ultimately plans, delivers, and then provides guidance for professional development training. When teachers shared stories of professional development, both positive and negative, the root of the issue inevitably traced back to leadership decisions or leadership's ability, or lack thereof, to intercede. Leadership in Midwest came in many forms, not just a few top district administrators. Boyd, Banilower, Pasley, and Weiss (2003) identified a wide spectrum of people who can serve this role of professional development leader. In Midwest, there were three primary levels of leadership, all with the power to shape and influence the types of professional development new middle school science teachers experienced in their first few years. These levels included district-level leadership, building-level leadership, and professional development trainers. District-level leadership included the superintendent, assistant superintendents, district-level directors, and subject-specific coordinators. Building-level leadership included principals, assistant principals, and counselors. Professional development trainers included district-level leaders, veteran teachers, mentors, and team leaders.

In this section, I will elaborate on how, and in what ways, these leadership roles influenced the effectiveness of new middle school teacher professional development. Several topics surfaced while considering the overarching role of leadership across the five categories of this study. These included decision-making/ownership, training, communication, and professional development delivery methods. These cross-categorical issues, and leadership's role in each, provided the basis for interpretation of findings.

Literature on professional development pointed out the importance of leadership and the effect it has on the overall success of new teacher learning. Youngs (2007) encouraged district policies that provide language to allow various levels of leadership, including district administrators, principals, mentors, and colleagues, to share in the responsibility of helping new teachers to acquire curricular knowledge, plan instruction, and reflect on practice. By promoting the learning communities model of professional development, Midwest leadership allowed teachers the opportunity to take ownership of their professional learning. Yet, findings revealed that while this learning communities model was ideal in theory, concerns existed.

District administration in Midwest expected all middle school building-level administrators to use learning communities. Miles (2003) and Wong (2004) advocated for schools that embrace the notion of daily or weekly work time for teachers to collaborate with each other in planning for, creating, and implementing standards-based curriculum. But top district administrators did not formally or consistently train building administrators on how to develop and sustain such programs. District administration expected ongoing, job-embedded professional development to occur, but district leadership seemed to provide little training or direction on how that model should be

organized and implemented at the building level. Then, team leaders and teachers were often left to interpret the goals and expectations of learning communities within these buildings. The lack of training seemed to impact the success of professional learning communities within particular buildings.

Nonaka and Takeuchi (1995) might suggest Midwest used a top-down model of leadership instead of a “middle-up-down” approach of organizational management. In Midwest, most professional development activities originated with top district leaders and trickled down to building-level principals who attempted implementation with staff. Leadership in Midwest might examine the appropriateness of middle-up-down management techniques to allow more interplay between the needs of teachers and principals when creating and implementing initiatives. For example, rather than district leaders telling all principals to begin a specific initiative, by using the middle-up-down model, principals could evaluate the initiative with teacher input and then have the flexibility and decision-making power to implement the initiative in ways that match that building’s and staff’s needs. It seems to me that to help ensure consistency across buildings and accountability across the district, Midwest has generally justified a top-down model of leadership for many professional development decisions.

In addition, inconsistent communication between district and building-level leadership allowed for multiple interpretations and implementation of the learning communities model. Interestingly, though, even without official district training and with inconsistent communication, many buildings reported success with learning communities. What made the difference for these buildings?

Perhaps the success of learning communities hinged on the skill set of the building-level administrators and district leaders who organized and implemented professional development programs. When these leaders effectively organized and spelled out the expectations of learning communities, teachers felt they had ownership of their learning. Teachers found job-alike professional development, where teachers could sit and discuss science-specific ideas, to be helpful and useful. Furthermore, teachers described professional development as being of lower quality when building-level leadership did not clearly set up positive situations or intervene when collaboration did not happen, or when direct instruction was the primary form of delivery. This aligns with research by Loucks-Horsley (1999), which found that:

...the quality or nature of professional development consists of four clusters of variables: content (what is to be learned); process (how content is to be learned); strategies and structures (how content is organized for learning); and context (conditions under which content is learned). (p. 259)

In Midwest, professional development success seemed to hinge on all four clusters suggested by Loucks-Horsley, including how well leadership initially organized and implemented an environment in which adult learning could occur.

In those middle school buildings where I interpreted a lack of high quality professional learning communities, principals and other leaders seemed to set a rigid agenda for professional development topics with little teacher input. In some cases, the trainings simply involved lectures. Often, the focus of science professional development in these buildings focused on narrow goals, such as raising state test scores. Surprisingly, some building's science professional development time stretched the imagination by

focusing on how to support and help raise student sub-group literacy scores on the language-arts state test. Teachers from these buildings explained that most of the goals were admirable and worthy of discussion, but that those goals did not specifically help new science teachers. Abell et al. (1996) discussed the importance of science teachers improving their practice by collaborating with others who share the curriculum and can challenge each other's assumptions about how kids learn science through inquiry. In those middle school buildings who had seemingly dysfunctional learning communities, teachers seemed frustrated with the perceived disconnect between professional development activities and teaching science.

Guskey's (2003) document analysis of the characteristics of highly effective professional development programs noted three main themes. They included emphasis on helping teachers to understand more deeply the content they teach and the way students learn that content. Also important was allowing teachers sufficient time to deepen understanding, analyze students' work, and develop new approaches to instruction. The third theme was promotion of collegiality and collaborative exchange to build a sense of community. In the buildings where learning communities worked, the leadership seemed to incorporate each of these components. But Midwest's orientation week was one aspect of new teacher professional development that did not mesh with Guskey's (2003) findings.

New middle school science teachers perceived district leadership in Midwest to struggle with providing memorable adult learning situations during orientation week. In the analysis of teacher interviews and observations, it came to light that during new teacher orientation week, district-level leadership utilized direct instruction almost

exclusively. Teachers said the format and delivery methods of this training was too theoretical and was typically delivered in lecture style format. Conversely, Taylor (2000) explained that professional development best stimulates adult learning through participation, collaboration, exploration, critical reflection, and feedback. Such transformational learning-inducing methods were not utilized by Midwest leadership, at least not during orientation week when new teachers are first thrust into the culture of teaching in this district.

In fact, teachers perceived delivery methods used by Midwest leadership during orientation week to be quite contrary to the ideals associated with transformational learning. Teachers had difficulty digesting copious information in a short time span. They thought the timing of the training was ineffective because they had not yet taught any curriculum and their inexperience prevented them from implementing most of the strategies and expectations. Both teachers and district administrators noted flaws in new teacher orientation, but neither group expressed any viable alternatives for providing the amount of information that needed to be covered before the school year began. It almost seemed as if the flaws in the delivery methods of orientation were well-known, but Midwest leadership seemed unwilling or unable to change the format.

Even though teachers found flaws in the district-sponsored formal orientation training, teachers reported receiving quality professional development through other delivery methods during the school year. As previously mentioned, this occurred primarily in the form of job-embedded learning communities and middle school schedules that support teaming. Reportedly, for several years, Midwest district administrators had spread the vision, message, and expectations for learning communities

within the middle schools, and how team time should be used for teacher collaboration and ongoing teacher professional development that leads to increases in student achievement. This district leadership-sponsored message led most teachers in this study to perceive support from school-based groups and teams. This also paralleled DuFour's (2005) summary of educational research, which indicated that teachers who work together to solve problems or to change practices have an advantage over teachers working in isolation. One of the most valuable ways teachers gain professional development in Midwest was through ongoing daily and weekly collaboration among teachers.

This research study sought to learn how, and in what ways, professional development supported new middle school science teachers. Leadership's communication played a key role in the effectiveness of professional development. Administrators and teachers in this study commented on the frequency and sheer number of district initiatives. Teachers in Midwest shared that too often there was inadequate communication or explanation for the changes and initiatives. Teachers wanted to know the reasons why the district was moving in a particular direction. For example, was the initiative started because one person read a great article, was it based on a district-wide survey, or was it based on a perceived need for all teachers to improve in a particular area? Therefore, it seemed that district leadership often used a top-down model of leadership. There was a lack of, or at least an inconsistency with, communication for professional development. This occurred both between district leadership and building leadership and between building leadership and the teacher-level staff. I believe teachers

in Midwest responded best when they felt ownership and were part of the decision-making mechanism for their own learning.

While district and building leadership's communication was a concern among many teachers in this study, there was one area where teachers viewed leadership's communication as a strength. Professional development trainers, veteran teachers, team leaders, and mentors were the third key level of leadership that affected the support of new teachers. These individuals all appeared to have a hand in the delivery of school based professional development in the learning communities model. Most new teachers were satisfied with communication from this tier of leadership, particularly regarding professional development delivery methods and levels of support. Teachers said that these individuals or teams of people provided them with opportunities to ask questions, collaborate on lessons and labs, and discuss assessment techniques and other district initiatives on a weekly basis. Mezirow (1997) promoted this idea of interactive discourse, which fosters transformational learning. Teachers in Midwest reported that much of their professional development was delivered in this informal manner. Teachers perceived the most support in these teams and groups.

In summary, the theme of leadership cut across all five categories of research findings, from induction to the types of adult learning experienced by new middle school science teachers. New teachers wanted to feel that they have some ownership in their professional development; they desired a role in deciding what types of learning they will experience. District and building leaders should recognize that new teachers search for such empowerment, and leadership should seek opportunities to share decision-making with teachers. Leadership needs to adequately and appropriately communicate. All levels

of leadership need to be proactive and collaborative when working with new teachers, and with all teachers. It is clear that simply instituting policies, like professional learning communities, is not enough for large suburban school districts. Proper and consistent training for leaders and teachers is crucial to ensure the appropriate delivery of high-quality professional development.

Relationships and Collaboration

Another theme that emerged in data analysis was whether or not new middle school science teachers made relationships with co-workers and teams. In this study, new teachers reported that finding at least one other person with whom to build a strong connection made a big difference in the overall perception of feeling supported. Wells (2007) listed ten design factors associated with effective models of professional development. Among these factors were collaboration and support. Positive relationships played a significant role across all five categories of this study. In this section, I will elaborate on how, and in what ways, relationships affected the effectiveness of new middle school teacher professional development. Interpretation of findings focused on the different types of relationships and the role of relationships on adult learning.

New middle school science teachers in Midwest were able to find positive relationships with various staff members during their first years on the job. Relationships were forged with different groups; including mentors, science job-alike partners, and grade-level teammates. But teachers also relied on relationships with the district's science coordinators' office, groups of science teachers from other buildings, and other new teachers in their own school building. Relationships with any combination of these individuals or groups helped to motivate and inspire new teachers to collaborate and

share new teaching strategies and lab ideas. This aligns with the research of Wong (2004) and Youngs (2007), which encouraged networking and explained that support for new teachers cannot rely solely on the mentor. The best support was provided by a variety of groups within the school who were willing to collaborate with the new teacher.

Most new teachers in this study found mentors and teams who were willing to commit to relationships of trust and friendship. The few teachers who reported a lack of positive support seemed to lack those critical relationships that welcomed them into a team. While some new teachers spoke of having reciprocity issues with teammates, others mentioned personality mismatches, and others seemed preoccupied with personal issues. Those teachers who reported powerful bonds spoke of hanging out during the summer and weekends with new buddies from work. Wong (2004) emphasized and advocated for multiple types of people and teams to be responsible for guiding new teachers. At the other end of the spectrum, “unsupported” teachers had little to say about support systems or work friends. Phillips (2003) might point out that their school culture did not fully embrace collaboration among teachers as the key to success when working with new teachers.

While research supported the importance of learning communities and collaboration, one finding emerged that was not as prevalent in the research. This finding related to the tendency for second career new middle school science teachers, who were already in their thirties or forties, to have difficulty forming bonds and relationships. Perhaps the older teachers’ busy personal lives limited their time to hang out after school for extra-curricular activities or social gatherings. These second career teachers spoke about leaving school immediately and taking work home so they could pick up the kids

from the babysitter or run to coach little league practice. Generally, brand new teachers with less personal responsibilities may have had relatively more time to invest in work relationships, and thus felt more supported than second career teachers. Also, perhaps the co-workers of second career new teachers inaccurately perceived the appearance of maturity, life experience, and poise as signs that those new teachers did not require assistance during their first few years. Johnson and Kardos (2002) found that these mid-career teachers moved schools more frequently than new teachers because they could more easily recognize situations that were not ideal, and they had the maturity to act by changing schools or being proactive to try to resolve problems. But, it seemed that new teachers of all ages and experience needed opportunities for relationships and social connections in order to feel positively supported in their professional development.

Teachers who commented on having strong personal relationships with a mentor or with another new teacher on a different grade level reported more positive perceptions of feeling supported. Mezirow (1997) believed that creating an atmosphere for effective discourse requires learners to have full information, have no coercion, have equal opportunities in discourse, have time to reflect on assumptions, and remain open to other perspectives. Simply presenting new information with a PowerPoint presentation will not automatically result in an ideal environment for adult learning. Teachers and administrators repeatedly touted the benefits of professional learning communities. In this environment, ideas were shared and teachers collaborated. This collaborative learning environment was consistent with Mezirow's (1997) research, which explained that transformational learning occurs within the context of equal participation in adult learning groups.

Unfortunately, some Midwest administrators and veteran teachers falsely assumed that because many new science teachers put on a good face and seemed mature or confident, they didn't need others to reach out and make personal connections. The reality was that all new middle school teachers in this study desired assistance. Even if they didn't independently come forward to request help, new teachers desired mentors to reach out more often, and they desired more science content training. Mezirow (1997) explained habits of mind as a set of predisposition codes that are cultural, social, political, economical, and educational, and help shape our point of view. Ideal conditions for transformational learning include "a safe, open, and trusting environment" (Taylor, 2000, p. 154) that allows for participation, collaboration, exploration, critical reflection, and feedback. In this study, those teachers with a caring, trusting learning group were more likely to feel supported and to report high levels of reciprocity and collaboration. Teachers who did not belong to groups that took into account their habits of mind and points of view reported less overall support from their professional development programs.

In summary, for Midwest professional development planners, the relationship theme may have taken a back seat to discussions of structure, content, and timing of trainings. Possibly, the leaders, mentors, teams, and staff members assumed that relationships for new teachers were present and ideal. But the theme of an ongoing need for positive relationships emerged frequently in this study. Relationships seemed to influence the overall new teacher experience to such a degree that they are among the most important variables for new teacher success.

Follow-up and Feedback

The last of the three major themes that permeated all five categories of this study was follow-up and feedback on professional development trainings and initiatives in Midwest. Concerns with feedback surfaced in the first teacher interview, and these concerns were peppered throughout subsequent interviews. There was an overarching sentiment, from both teachers and district administrators, that little follow-up or feedback occurred after most professional development sessions and district initiative trainings. Alternatively, the informal job-alike time set aside in the learning communities model of professional development was the most likely place for new science teachers to find positive, effective feedback.

In this section, I will elaborate on the role of follow-up and feedback on the effectiveness of new middle school science teacher professional development. Several topics surfaced while considering the role of feedback across the five categories of this study. These topics included science-specific knowledge, the number of initiatives to be implemented, and accountability. These cross-categorical issues, and the role of follow-up and feedback in each, provided the basis for interpretation of findings.

In Midwest, building principals typically observed and evaluated new middle school science teachers four times a year. But many teachers described those observations as mere formalities. The observing principals and non-subject-specific mentors often did not have a science background, and they did not understand the needs of science teachers who were trying to incorporate inquiry-based learning strategies. Post-observation feedback, therefore, was often of little or no help. New science teachers described this feedback as generic, and most teachers said they would gladly participate

in more subject-specific professional development, if offered by Midwest. Brown and Abell (2007) brought up the importance of helping new science teachers understand the complexities of inquiry-based learning. Unfortunately in Midwest, because the individuals who performed new science teacher observations often did not have science backgrounds, they could not provide the kinds of feedback or thought-provoking questions necessary for professional growth in the area of science.

Some teachers reported mentors and evaluators who did have a background in science. Yet, even these teachers expressed that not enough emphasis was placed on continuous feedback or on challenging that teacher's paradigm. Merriam (2001) and Mezirow (1997) explained that adult learners need to experience new world views and reflective discourse to help change their paradigms and to experience transformational learning.

Thankfully, Midwest's science coordinators seemed to fit the bill regarding both science knowledge and adequate follow-up. These science coordinators reportedly offered valuable resources, shared ideas, and facilitated group collaboration. Because these coordinators covered K-12 science education district-wide, they were not available to new middle school science teachers on a regular in-person basis. However, their positive influence, guidance, and feedback were certainly not overlooked by new middle school science teachers.

Accountability is another factor that affected new science teachers' perceptions of adequate follow-up and feedback. The bottom line in much of today's educational world is test scores and increased student achievement. Best practice for science teachers is to follow the National Science Education Standards (NSES) to facilitate the types of change

that will increase student achievement (National Academy of Sciences, 2007). Yet, who looked after Midwest's new science teachers to ensure that they followed these guidelines, such as planning inquiry-based lessons, designing hands-on labs, and developing communities of science learners? During interviews, teachers could not clearly explain how often they received subject-specific training, nor to what degree they were expected to implement best practices. Midwest's district administrators expressed the need for instructional coaches who might follow-up with new science teachers and make them more accountable for improving their instruction. At the time of this study, though, unless teachers self-reported or building principals spotted concerns, there was only one group to follow-up on best practices for science teaching: the two science coordinators. As mentioned previously, because these science coordinators were responsible for K-12 science teachers, they just did not have the time to devote to consistent and adequate follow-up and feedback.

Analysis of interview data revealed that the constant onslaught of new initiatives was too much for teachers, many principals, and even professional development trainers. New teachers reported that trainers often appeared to struggle with explaining new concepts or how to implement them in a classroom. But, how can anyone effectively help new teachers if initiatives are brand new, short-lived, or if there are so many initiatives that no one is sure about implementation? Johnson (2006) found that programs with durations of over 80 hours had the most success with teachers actually changing their instructional techniques in the classroom. I sensed that perhaps no district-sponsored formal trainings came close to 80 hours in duration. However, there was one exception:

the informal, job-embedded professional learning communities of weekly job-alike and grade-level team times.

Teachers complained of being overwhelmed with multiple initiatives coming at them from different levels of leadership. Marzano (2000) questioned districts that set too many initiatives which overwhelm teachers. One-shot trainings with no follow-up or ongoing education were not ideal for effective, long-term change. According to Cranton and King (2003):

Meaningful professional development must go far beyond learning to use a new piece of software or a new trick for increasing student participation. It must involve educators as whole persons—their values, beliefs, and assumptions about teaching and their ways of seeing the world. (p. 33)

Midwest's constant barrage of initiatives kept trainers from engaging new teachers' values, beliefs, and assumptions. Teachers reported follow-up on new initiatives that often involved a simple checklist, and not the kind of self-reflection suggested by Cranton and King.

Another issue with feedback in some Midwest school buildings was related to the loss of organizational memory and turnover rate. For example, in one middle school building, both eighth-grade science teachers were new and they had little collaboration time to meet with teachers from other buildings. Those teachers reported feeling like they were constantly reinventing the wheel with little feedback on their performance. Marsick and Watkins (2001) might call this type of learning informal or incidental learning, which is gained by trial and error through experience. District leaders in Midwest indicated that they pride themselves on creating adult learning situations that provide more socially-

constructed knowledge through ongoing, job-embedded professional development. Socially-constructed learning did occur for most teachers in this study through their job-alike teams. But that ideal learning was not consistently provided for new middle school science teachers across the district.

In summary, new Midwest middle school science teachers desired more quality science-specific feedback. Because feedback often did not challenge their paradigms, new teachers were left to their own devices to learn and improve their science instruction during those first few years in Midwest. Most relied on their job-embedded, job-alike teams, while some relied on trial and error, to make instructional changes. Teachers noted significant concerns with the sheer number of initiatives that they were expected to implement. Additionally, the issues associated with accountability in a large suburban school district made it difficult for new teachers to receive the follow-up and feedback they needed to make positive changes.

Implications and Conclusions

The results of this study supported much of the research on professional development and adult learning discussed in Chapter Two. Several of the major professional development topics, such as the professional learning communities model of professional development and the important role of mentors, were substantiated in this study on new science teacher professional development. Some key adult learning topics, including transformational learning and learner-centered professional development, were highlighted in this study. In addition, this study revealed the significant role played by leadership in new teachers' professional development, the importance of new teachers

forming relationships, and new teachers' expectations of and need for feedback and follow-up.

The research questions that guided this study sought to understand how, and in what ways, suburban school districts supported new middle school science teachers through professional development that incorporated adult learning theories. In many ways, this study aligned with current research. Midwest School District incorporated many of Guskey's (2003) characteristics of highly effective professional development programs. By promoting the learning communities model for middle school science teachers, Midwest seemed to emphasize three of Guskey's main themes: (a) helping teachers understand the content they taught, (b) allowing teachers sufficient time to develop instructional approaches, and (c) building a sense of community through collaboration. This study found that the three overarching themes of leadership, relationships, and follow-up dictated whether these ideal conditions for professional development were effective for new middle school science teachers to actually feel supported when learning new skills and attempting to improve practice.

The impact of leadership on the effectiveness of learning opportunities to which new teachers were exposed during professional development cannot be overlooked. District administrators, building-level principals, and district science coordinators were charged with planning and implementing workshops and activities during new teacher orientation and throughout the new teachers' first few years. The types and quality of professional development was truly in the hands of these leaders. Generally, those leaders set up the expectation for effective adult learning. But, the implementation of various

initiatives and programs is where the leaders from some buildings fell short of the goal to improve science instruction and change practice during teachers' first 3 to 5 years.

The leadership in several middle school buildings and teams in Midwest succeeded in supporting new middle school science teachers. These leaders shared the following characteristics: provided teachers with choices for professional development, and in doing so, gave teachers a sense of ownership; matched teachers with caring mentors; identified the struggles and individual needs of the new teacher; provided clear expectations of involvement during collaboration; expected learning community groups to meet weekly; expected reciprocity among team members; varied professional development instruction by moving away from direct lecture; allowed adequate time for an initiative to be fully implemented; and provided relevant subject-specific feedback and reflection time. New middle school teachers with leaders who demonstrated these characteristics expressed perceptions of being supported. They reported that this support helped evoke positive changes in their teaching during their first few years.

Literature described the importance of providing new teachers with several layers of support, and it appeared that Midwest did indeed set up and plan for these multiple layers of support. In this study, a new science teacher's formation of a strong relationship with one or two co-workers had a significant influence on that teacher's perception of support. So, this study's findings did not contradict the need for multiple layers of support. Rather, it seemed that these multiple layers offered the new teacher more opportunities to make those important bonds.

Successful mentors and teams in Midwest did several effective things, including: welcomed teachers into their groups; collaborated weekly; shared documents and lessons;

respected input from new teachers; provided science-specific feedback; and made a personal connection that continued outside the school setting to outside functions, hobbies, and social events. These types of relationships were formed both in schools that reported high quality leadership and in schools where high quality leadership was not reported. Therefore, the relationship theme was another powerful influence over perceptions of support and the amount of learning that occurred during those first few years of teaching.

This study noted the importance of follow-up training sessions but found that teachers perceived them as few and far between on many initiatives. As noted in Chapter Two, one-shot trainings with no follow-up or ongoing education are not ideal for effective, long-term change. Additionally, standards-based teaching practices linked with programs with durations of over 80 hours find the most success with teachers actually changing their instructional techniques in the classroom (Johnson, 2006). Teachers in this study envisioned ideal follow-up to: occur at least monthly, provide clear expectations of the scope and frequency of implementation, be subject-specific, aid in self reflection, and allow for discourse.

Educational research highlighted the need for teachers to have support even after a training workshop ended. This helped to shed light on why most teachers in Midwest felt unsupported during the implementation phase of professional development. The programs in Midwest were far from one-shot workshops, yet very few initiatives allowed for collaboration and work time that lasted 80 hours. It seemed that the work time and follow-up sessions fell somewhere in between. New middle school science teachers in Midwest perceived this as not quite enough to meet their needs for feeling supported and

confident with their level of implementation of professional development ideas and district initiatives.

This study's findings corroborated some current research on theories of adult learning that were detailed in Chapter Four. Adult learning research supported the perceptions of science teachers and district administrators in this study regarding socially-constructing knowledge as one of the most effective forms of adult learning. Mezirow (1997) believed that creating an atmosphere for effective discourse requires educators to allow learners to have full information, have no coercion, have equal opportunities in discourse, have time to reflect on assumptions, and remain open to other perspectives. Simply presenting new information will not automatically result in adult learning. The atmosphere surrounding what most new teachers experienced in Midwest's quality learning communities mirrored Mezirow's suggestions for effective adult learning. Midwest teachers looked positively on socially-constructing knowledge of their curriculum and assessment practices. They described this as the most powerful when they were allowed informal work time to reflect and share perspectives.

The research that was laid out in Chapter Two supported and confirmed the findings and interpretations of this study regarding how, and in what ways, new teachers either felt supported or not during their first few years in the field. Professional learning communities were valued by new middle school science teachers in Midwest. Ensuring that they are not only encouraged, but also properly implemented is critical. The influences of leadership, relationships, and follow-up and feedback are some of the primary issues that educators concerned with creating and encouraging high-quality

professional development for middle school science teachers need to consider. In the next section, I will share some implications for practice and research.

Implications for Practice

The findings and interpretations of this study spoke to public school leaders in large suburban school districts who wish to modify and improve professional development for new teachers. A better understanding of new middle school science teachers' perceptions of professional development during their first few years should help professional development coordinators, administrators, trainers, mentors and policy makers consider areas of change or improvement. As this study highlighted, even when a high-performing school district like Midwest set up the vision and structure for research-based professional development, issues of leadership, relationships, and follow-up had profound effects on whether or not the teachers actually felt supported or made real changes at the classroom level.

First, large suburban school districts like Midwest should conduct internal data analysis through surveys, interviews, and observations to determine the degree of high-quality professional development that is actually implemented in all school buildings. This involves more than a simple interview with a building principal or looking at a school's professional development plan on paper. Yet, I do not suggest a lengthy, dissertation-type study. If a few administrators devoted some time to investigating a school building's actual working model of professional development, it could yield some eye-opening revelations that could serve as a starting point for improving professional development. As this study revealed, district-level leaders in Midwest identified building-level principals who needed more training in the development of learning communities. If

that concern was known, why was there no follow-up to ensure that the training occurred? Interviews with, or surveys of, teacher-level staff could reveal needs that are not being addressed, such as creating unified expectations for the type of content to be delivered during staff development days and team times at the middle school level. While these types of internal data analysis occur in many large school districts, I suggest that school leaders take additional steps to follow-up on results and to actually confirm implementation of district-sponsored programs. Then, district leaders can better judge the level of teacher engagement, collaboration, and discourse that is needed to challenge and reform new teachers' perceptions on how to improve their teaching.

This first implication is rooted in this study's theme of leadership and how that leadership can truly shape a new middle school science teacher's perception of support through professional development efforts. Policy makers and district administrators must first be able to identify and recognize which leaders need help organizing professional development, and which buildings' teachers agree that professional development activities simply pass information along through rote activities. School districts that can identify these "in-need" buildings and building-level leaders are more likely to ensure quality professional development experiences for all teachers.

Second, district and school leaders must prioritize mentor training and appropriate mentor selection. The relationship theme was pervasive in this study. A new teacher's sense of welcome or acceptance into the school culture was greatly impacted by whether or not he made a personal bond with at least one or two individuals. The mentor seems to be an ideal person with whom to begin building such bonds. School districts should put more thoughtful consideration into the mentor selection process. School leaders can also

be more proactive in identifying those new teachers who seem to need more support. For example, principals or mentors can encourage a new teacher or teammates to join a study group or book club, suggest that a new teacher sponsor a student group, or promote participation in staff social interactions during or after schools hours. School leaders should not assume all is well with new teachers just because the teachers don't report problems. Rather, school leaders should assume all new teachers appreciate and need support, guidance, and friendship during their first few years.

Third, to assist new teachers with improving their teaching strategies, school leaders, professional development trainers, and new teachers should insist on being provided ample time to implement new ideas and to then be observed by others for quality feedback. Teachers in this study rarely reported proper feedback. Therefore, the teachers either assumed everything was satisfactory and thus had little motivation to incorporate changes, or they realized they needed assistance yet rarely received the type of feedback that left them feeling supported. The implication here for school leaders is simple: someone must actually take the time to check in on, observe, discuss, or collaborate with new teachers during the implementation phase of professional development.

An unfortunate assumption that school leaders make is that if new middle school science teachers appear to be alright, display no obvious problems, and do not request additional feedback, then no help is needed. Help should be offered and made readily available, nonetheless. This recommendation may require the hiring of additional staff. It may involve rearranging the timing and sequence of programs so that reflection and feedback time are built in. It would also be difficult to build in accountability measures.

Yet this study repeatedly found evidence to support these types of major changes in Midwest's profession development programs.

Implications for Research and Theory

There are several implications for future research in the area of professional development for new middle school science teachers. First, how much, and in what manner, do new teachers need follow-up and feedback to effectively support their professional development? As previously mentioned, Johnson (2006) suggested that professional development programs with durations of over 80 hours seem to make a difference in the success teachers found at changing their teaching practices. I suggest a further study that looks at the quality and characteristics of that follow-up and feedback provided to new teachers. At what point do new teachers begin to perceive too much pressure or too many expectations from leaders who increase their involvement and feedback for initiatives? Given limited amounts of time and resources for professional development, how would districts set up programs that increase follow-up and feedback while maintaining other professional development initiatives and programs? This study suggests that new middle school science teachers desire more feedback, but how would a program be designed, and how effectively would it increase new science teachers' implementation of inquiry-based instruction and other district initiatives?

Second, this study identified the learning communities model as a key method for delivering daily and weekly professional development opportunities to new teachers in Midwest. Would creating more opportunities for science teachers to meet and collaborate with teachers from other buildings increase their perceptions of support and advance their learning? It was suggested that some new middle school science teachers in Midwest

maintained contact with other middle school science teachers for additional support during their first few years, but they rarely met more than twice a year. Would expanding the learning communities to involve other buildings within a school district increase perceptions of support and increase changes in the classroom?

Third, Blackwell (2004) suggested that pre-service university programs are not adequately training new teachers with skills and concepts to hit the ground running during their first years. Future research could examine the link between pre-service programs for science teachers and their need for additional content training and general teaching skills. This may shed more light on why new middle school science teachers in this study often struggled with implementing research-based professional development in their first few years of teaching.

Fourth, this study included interviews with new middle school science teachers and district-level administrators. Future studies could include interviews with mentor teachers and building-level principals. Their insight and perspectives into the induction and training of new middle school science teachers could support or refute findings from this study. Interviews with these two levels of leadership could reveal specific reasons why communication with leadership, positive relationships, and follow-up and feedback are (or are not) occurring.

Finally, there is not a significant amount of research that directly links student achievement in middle school science to quality teacher professional development in the form of learning communities. This is due, in part, to additional variables that can affect student achievement from year to year. I suggest a long-range study of middle schools that implement high quality professional development in the form of learning

communities and investigate how their student achievement data changes over multiple years. It would be interesting to learn if researchers can isolate those schools that truly engage in quality learning communities, as described by DuFour (2004) and Guskey (2005), and the patterns of science achievement, as indicated by state test scores or other like assessments. This study found elements of learning communities and professional development training programs that were perceived as effective or ineffective without linking those perceptions to student achievement data. With an increasing focus on school standards and accountability for student learning, this future study could help link those perceived effective elements of professional development with what many say is the bottom line: test scores.

Summary of Conclusions

This chapter presented my interpretations of major findings and themes that emerged during my investigation of the professional development of new middle school science teachers in a large suburban school district. The major themes revolved around the roles of leadership, staff relationships, and quality subject-specific feedback. These findings are supported by literature on professional development and adult learning theories and should be transferable and generalizable to many other large suburban school districts who seek to better support new teachers through district-sponsored professional development programs.

This study found many perceived barriers to implementation and support. But the most profound issues that emerged were the delivery methods used by professional development leaders, the relationships formed during the delivery method, and the feedback teachers experienced after the initial training. Teachers perceived the most

effective delivery method of professional development was in the form of informal site-based learning communities. Teachers perceived that support was more powerful when friendships were formed with staff members. And ultimately, leadership's expectations before a training session and the feedback after a training session determined the degree of implementation and changes that new teachers made.

Large suburban school districts face the daunting tasks of planning, implementing, and ensuring quality control of professional development programs for hundreds of teachers each year. At the same time, the leaders in these school districts must manage the non-stop addition of new teachers. Through this research study, I hope to remind school leaders, teachers, and mentors that although the new teacher down the hall may never e-mail, call, or yell for help, that teacher probably would appreciate you checking in from time to time. By offering friendship and reflective discourse, you may help a new teacher make sense of struggles, experiences, and successes as a new middle school science teacher.

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APPENDICES

APPENDIX A

Permission Letter

Midwest Administrator:

My name is David Witt, University of Missouri-Columbia graduate student. I am writing to ask for permission to collect data for my dissertation titled, "An Exploratory Study of Professional Development Experiences for New Middle School Science Teachers in a Suburban School District."

I would like to ask several teachers, mentors, and administrators for a brief interview during the next several months. I will also be asking for related documents regarding the professional development of new teachers. The IRB office at Mizzou has reviewed my research proposal and methods, and is requesting the district's official written permission before I conduct my interviews and begin collecting documents.

I will do my best to maintain confidentiality during the collection, analysis, and reporting of data. Confidentiality is of utmost importance. In my dissertation, I plan to use pseudonyms to ensure confidentiality, and the name "Midwest" [pseudonym] will not appear in the final submission to the university.

Thank you for your consideration on this matter.

Sincerely,

David Witt

Permission Granted By: _____

Date: _____

APPENDIX B

Recruitment E-mail

Midwest Staff Member:

My name is David Witt. I am a graduate student at the University of Missouri-Columbia, and am working on my dissertation. You have been identified as a possible participant for my qualitative research study titled, "An Exploratory Study of Professional Development Experiences for New Middle School Science Teachers in a Suburban School District."

Your participation is totally voluntary, and you can withdraw at any time. Your identity will be kept completely confidential during the collection, analysis, and reporting of data. The school district has granted me permission to collect data and documents for this study.

I am asking you to participate in a brief interview related to the topic of professional development of new science teachers. Your time is valuable, and I will make the interviews as convenient as possible by traveling to your location any day that is most convenient for you.

Please respond to this e-mail if you have any questions, to set up an interview time, or to be removed from my list of possible participants.

I will follow-up with you soon. Thank you for your time and assistance.

Sincerely,

David Witt

APPENDIX C

Participant Consent Form

AN EXPLORATORY STUDY OF PROFESSIONAL DEVELOPMENT EXPERIENCES FOR NEW MIDDLE SCHOOL SCIENCE TEACHERS IN A SUBURBAN SCHOOL DISTRICT

Thank you for your willingness to participate in this study. This research study is a qualitative analysis of the professional development of new middle school science teachers. Through this research, I hope to determine the effectiveness of new teacher induction and training, based on current research on adult learning theory and high-quality professional development.

Your participation is voluntary. If, for any reason, you wish to decline to participate in this study, you may do so at any time. Your confidentiality will be strictly protected. On any transcripts and interviews, your name will be deleted and replaced with a pseudonym. The dissertation student will be the only individual who has access to a master list that matches your name with the pseudonym. All data collected must be stored for 3 years from completion of the project.

Interview data will be collected using open-ended questions, and each of the semi-structured interviews is expected to last approximately 45 minutes. Interviews will be conducted at your convenience. Interviews will be digitally recorded to ensure accurate data collection and to facilitate data analysis. Digital recordings from interviews will be transcribed by the dissertation student. As soon as the transcriptions are complete, all digital files will be securely stored and erased after 3 years. Follow-up questions may be required at a later date if interview information is unclear regarding meaning or understanding of dissertation themes.

Benefits of the study include gaining a better understanding of the barriers involved in training new science teachers, possible influence in future professional development offerings to science teachers, and self-assessment through reflection on their first years of experience in the district. A potential risk to study participants includes the fact that they will discuss strengths and weaknesses of a district program.

Please feel free to ask any questions during or after your participation in this study:
David Witt, xxx-xxx-xxxx (cell).

If you have any questions at a later date you may call my dissertation advisor:
Jay Paredes Scribner, Associate Professor of Educational Leadership and Policy
Analysis, xxx-xxx-xxxx.

For questions regarding the use of human subjects in research, please contact:
UMC Campus IRB Office, 573-882-9585.

Your signature below indicates that you have read and understand this statement, have received a copy of the statement, and are willing to participate in this study. Thank you for your time.

Signature: _____ Date: _____

Print name: _____

APPENDIX D

Teacher Interview Questions

1. I'd like to begin by asking you to discuss what you feel are your current strengths as a teacher.
2. What do you feel are the areas that you would like to most improve as a teacher?
3. Think back to new teacher orientation week, when you first began.
 - What topics and activities did you find useful during that orientation week? Please give examples and explain why.
 - What topics and activities did you find least useful during that orientation week? Please give examples and explain why.
 - Please offer a recommendation for additional topics during orientation? Also, explain why or how you think the topic would be beneficial.
4. Without providing specific names, what person or colleagues did you rely on most during your first year or two of teaching? For example, grade-level team members, administrator, mentor, subject area coordinator, or someone else?
5. Were you offered a subject-specific mentor?
 - Explain the role of that mentor during your first years.
 - How often did you discuss subject-related material with your mentor?
 - Explain the usefulness of the mentor program.
 - Please explain any aspects of the mentor program that you did not find to be helpful.
6. Explain the types of subject-specific professional development you have had up to this point.
 - Explain how these subject-specific professional development offerings were delivered. For example, were they informal, formal, summer intensive workshops, professional development days, or something else?
 - What delivery system do you feel is most useful to new teachers? Please give examples and explain why.

- What delivery system do you feel is the least useful to new teachers? Please give examples and explain why.
 - How do the facilitators conduct training sessions? For example, do they use lectures, PowerPoint presentations, group work and discussions, hands-on modeling, simulations, book studies, or something else?
 - What aspects of the curriculum training have been most useful? Please give examples and explain why.
 - What aspects of the curriculum training have been the least useful? Please give examples and explain why.
 - What additional subject-specific training would benefit you the most?
7. What barriers, if any, keep you from implementing new science strategies and district initiatives into your lessons?
8. Explain how your first years of professional development have challenged your current philosophies on how to teach.

APPENDIX E

Administrator Interview Questions

1. Describe for me what kind of induction experiences and professional development new science teachers get in this district?
 - In what ways are those experiences the same or different from other new teachers and other teachers in general?
2. I'd like to explore a little about the content and the way that content is delivered to new teachers.
 - Describe the variety of topics that the district focuses on during these experiences that new science teachers are exposed to. This could include organizational issues like grading software, teaching to district standards, science standards, etc.
 - Describe how these teacher learning programs are delivered. For example, were they informal, formal, summer intensive workshops, professional development days, or something else?
 - What delivery system do you feel is most useful to new teachers? Please give examples and explain why.
 - What delivery system do you feel is least helpful to new teachers? Please give examples and explain why.
 - Based on your observations, how do professional development facilitators conduct training sessions? For example, do they use lectures, PowerPoint presentations, group work and discussions, hands-on modeling, simulations, book studies, or something else?
 - In your opinion, what other professional development should the district offer?
3. What is your perception of the effectiveness of the district's current induction and mentoring programs?
4. What changes would improve the district's induction and mentoring programs?
5. In your opinion, what barriers, if any, keep new middle school teachers from implementing professional development and district initiatives at the classroom level?

6. What other insights can you share to help me understand how professional development is organized and carried out in the district?

APPENDIX F

Coding Key

1. Induction
 - 1.1 Induction Content Usefulness
 - 1.2 Induction Content Not Useful
 - 1.3 Induction Formal/ Informal Delivery Effectiveness
 - 1.4 Induction Formal/ Informal Delivery Not Effective
 - 1.5 Induction Support System Effectiveness
 - 1.6 Induction Support System Not Effective
 - 1.7 Additional Desired Induction Content/ Training
2. Mentors
 - 2.1 Mentor Content Usefulness
 - 2.2 Mentor Content Not Useful
 - 2.3 Mentor Formal/ Informal Delivery Effectiveness
 - 2.4 Mentor Formal/ Informal Delivery Not Effective
 - 2.5 Non-Mentor Support System Effectiveness
 - 2.6 Non-Mentor Support System Not Effective
 - 2.7 Additional Desired Mentor and Support System Help
3. Science Specific Professional Development
 - 3.1 Science PD Content Usefulness
 - 3.2 Science PD Content Not Useful
 - 3.3 Science PD Formal/ Informal Delivery Effectiveness
 - 3.4 Science PD Formal/ Informal Delivery Not Effective
 - 3.5 Science PD Support System Effectiveness
 - 3.6 Science PD Support System Not Effective
 - 3.7 Additional Desired Science PD Content Training/ Support System
4. Barriers of Implementation for Science PD and District Initiatives
 - 4.1 Resources and Context Barriers
 - 4.2 Content Barriers
 - 4.3 Delivery System and Leadership Effectiveness
 - 4.4 Delivery System and Leadership Not Effective
 - 4.5 Additional Desired Implementation Support and Training
5. Perceptions of the Type of Adult Learning When Receiving District PD
 - 5.1 Transformational Learning
 - 5.2 Informal/ Incidental/ Assimilative Learning
 - 5.3 Learning Communities
 - 5.4 Direct Instruction/ Concrete Knowledge

VITA

David John Witt was born in 1975 and grew up in Sullivan, Missouri. He is the son of Bob and Brenda Witt. Brenda is a retired mathematics teacher and Bob worked as an engineer, miner, banker, and farmer. David and his younger brother, Brian, enjoyed a well-rounded childhood. They grew up on a working goat farm and were allowed the responsibilities and freedom to try many activities such as fishing, camping, boating, and working with farm animals.

While attending Sullivan High School, David earned varsity letters in basketball, track, and cross-country. He was both the St. Louis Post-Dispatch and U.S. Army Reserve Scholar Athlete recipient for Sullivan High School, and he graduated in 1993. He attended Maryville University in St. Louis, where he studied education under the instruction of Dr. Thomas Moeller. David played on the men's basketball team, was active in several university clubs, and worked as a resident assistant in the residence halls. He earned his B.A. in Middle School Math and Science Education in 1997.

David's began his teaching career in Lincoln County, Missouri, from 1997-1999. His first mentor, Kathy Lewis, helped him with the issues of teaching sixth-grade students. David coached middle school basketball and track, and started to work on his Master's degree under the guidance of Dr. Ed Hillhouse.

David moved to St. Louis County, Missouri, in 1999 and started his new teaching assignment as a seventh-grade math and science teacher. His science mentor, Kevin McColgan quickly helped David get involved in all aspects of middle school leadership and extra-curricular activities. One such leadership role was that of coordinator for the 21st Century program. David soon earned his M.S. in Educational Administration from Southwest Baptist University, and then his Ed.S. in School Administration/ Superintendency from Central Missouri State University. His CMSU thesis shared ideas and strategies for working with at-risk students in the block schedule. His work with at-risk students in the 21st Century Program led him to be concerned about his district's transition to 90-minute class periods and the issues the extended time might have on teachers and middle school students.

David met his future wife, Lisa, in the school copy room in 2000. She was working as a Speech-Language Pathologist for Special School District of St. Louis County. For the past 8 years, David has worked as an eighth-grade science teacher in St. Louis County. He has worn several hats during his career as a science teacher, including club sponsor, after-school activities coordinator, Science Olympiad coach, team leader, district-level committee volunteer, mentor, and building representative for the district NEA.

During his doctoral coursework through Mizzou from 2003-2005, he traveled back and forth to the Rolla satellite campus each week, and worked under the guidance of Dr. Dan Cockrell. David's interest in new teachers increased as he began mentoring new science teachers and student teachers from local colleges. Professional development was viewed as the most logical avenue to help assist these new teachers. After his doctoral

coursework was completed, David's first attempt at a dissertation topic focused on classroom management for new teachers. Dozens of research articles were read and several observations on this topic were made during 2006. In 2007, with the help of his advisor, Dr. Jay Scribner, David's dissertation topic evolved into a broader focus on the first years of induction training for new middle school science teachers. David Witt received his Ed.D. in Educational Leadership and Policy Analysis from University of Missouri-Columbia on May 15, 2009. David's passion for assisting and guiding new teachers will surely continue to grow as he considers possibilities for his future career in school administration or university-level teaching.