

Understanding Teacher Professional Identity Development: An Exploration of
Secondary Science Teacher Beliefs and Practices Through Reflective Practice

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Dedication

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Abstract

Teachers' beliefs about science teaching are established and nurtured through their own experiences as learners. While teacher beliefs have a significant impact on their classroom practices and provide a strong basis for their classroom actions, teachers' sense of identity has been shown to play a key role in their understanding of their own actions (Kelchtermans, 2005). New teachers are forced to confront their professional identities on a regular basis and in multiple ways during their beginning years in the profession (Thomas & Beauchamp, 2011). A greater understanding of their own identities can assist new teachers as they face many of the challenges in their careers.

This longitudinal qualitative study followed three beginning science teachers throughout a three-year induction period. The study used a framework of evolving *teacher identity* modified from Beauchamp and Thomas (2006) to explore the teachers' identity development in terms of their classroom roles and responsibilities, the ways they think of and describe themselves as professionals, and their beliefs and practices about their classroom teaching and student learning. The research design employed is an exploratory multiple case study (Yin, 2014) of three teachers working in high need schools. Data were collected from multiple sources, including classroom observations, teacher interviews, and reflective journals.

The findings provide insight into how beginning teachers perceived their identities based on the three themes: (a) role as a teacher; (b) teaching practice, and (c) enhancing student learning. The findings indicated that the beginning teachers' roles had fluctuated between "authoritative" and "facilitator" over the first three years as they struggled with classroom management. In two cases, the teachers reverted to direct

instruction during their first and second year, but over time they developed routines and pedagogical strategies to implement more student-centered, hands-on lessons aligned with their identity as “facilitator.” In the third case, the teacher’s practice maintained throughout the three years was primarily lecture with an occasional hands-on activity to promote student engagement, as opposed to learning. This traditional practice was aligned with his beliefs about his role as a teacher and how students learn in spite of his stated identity as a “guide.” This study informs teacher educators about the importance of reflection as they work to prepare future teachers and support in-service teachers in developing their identities and shaping their beliefs toward teaching in their classroom.

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CHAPTER 1: INTRODUCTION

Research has indicated that teachers possess a vast array of complex beliefs about pedagogical issues, including beliefs about students and classroom practices (Berliner, 1987; Borg, 1998, 2003; Burns, 1992; Shavelson & Stern, 1981). These beliefs form a structured set of principles and are derived from a teacher's prior experiences, school practices, and a teacher's individual identity (Borg, 2003). Furthermore, what teachers do in the classroom is governed by what they believe, as these beliefs often serve as a filter through which instructional judgements and decisions are made (Pajares, 1992; Cantu, 2001). Consequently, these teacher beliefs and decisions play an important role in student performance (Silverman, 2007). While a large body of research suggests that science teachers' beliefs have a significant impact on their classroom practice (Jones & Leagon, 2014), the National Research Council (2010) has pointed out that "there is very little systematic research about current practice in the preparation of ...science teachers" (p. 177). Most critical is an exploration of the induction period as this is a time when science teachers' practices and cognitive modes are conceptualized, constructed, and crystallized, the importance of this period is too often overlooked (Luft, 2007).

Research reveals that the beginning years encompass a vital phase of science teacher development (Bianchini, Johnston, Oram, & Cavazos, 2003; Luft, Roehrig, & Patterson, 2003; McGinnis, Parker, & Graeber, 2004; Roehrig & Luft, 2006) and, with appropriate induction support, beginning teachers' capacity for inquiry-based and student-centered teaching strategies can be improved (Luft, Roehrig, & Patterson, 2003; Confait, 2015). However, much of the research related to the induction period has had a singular focus on retention, ignoring the development of teachers' identity over their first

three years in the classroom. Hammerness, Darling-Hammond, and Bransford (2005) indicate that:

Developing an identity as a teacher is an important part of securing teachers' commitment to their work and adherence to professional norms...the identities teachers develop shape their dispositions, where they place their effort, whether and how they seek out professional development opportunities, and what obligations they see as intrinsic to their role. (pp. 383-384)

Teachers' beliefs, along with professional identity, influence their practices to cope with educational changes (Beijaard, Verloop, & Vermunt, 2000). The study of teachers' beliefs about their ability to impact student growth has led to an increased understanding of the practice of teaching. While beliefs form the core of what a science teacher thinks and guide how s/he wants to implement ideas and classroom practices (Lumpe, Haney, & Czerniak, 2000), reflective practice enables teachers to realize the influence of their beliefs on the instructional decisions they make and influences the ways in which new teachers' identities are shaped and reshaped over time. Teachers who are encouraged to engage in reflective practice can gain new insights into their practices (Ellis, McFadden, Anwar & Roehrig, 2015). As Borg (2003) has maintained, "teachers are active, thinking decision-makers who make instructional choices by drawing on complex practically-oriented, personalized, and context-sensitive networks of knowledge, thoughts, and beliefs" (p. 81). By engaging in reflective practice, teachers can construct and reconstruct their own beliefs and practices, and ultimately their professional identity, to provide optimum learning conditions for all students.

Teachers' identity development is influenced by their beliefs about teaching and learning (Gormally, 2016). Hence, teachers should consciously consider their beliefs, bringing them to "the level of conscious awareness" (Kagan, 1992, p.65), by reflecting on their practice throughout the induction period. As teachers reflect, their sense of identity has been shown to play a key role in their understanding of their own actions (Kelchtermans, 2005). While reflection is acknowledged as a powerful way for students and teachers to delve deeply into their teaching identities, researchers have little information about how a teacher's identity evolves over the course of his or her early career - a crucial gap in our understanding of teaching. Given that it is critical for teachers to be reflective on their practice that facilitates their continued growth during the induction period, this research contributes to the literature base on beginning teachers' identity development.

Thus, this study followed beginning science teachers throughout the three-year induction period and explored their practice, thereby enabling them to reflect on those practices that help build an understanding of their continuous process of science teaching development while identifying who they are as a teacher. The research questions guiding this study were:

- 1) How do beginning secondary science teachers' professional identities develop over their first three years in the classroom?
 - a) How does their reflection on their beliefs and practices mediate that transition?

Overview of the Following Chapters

Chapter 2 will outline the research literature that informs previous and relevant work for approaching the questions of the study. Chapter 2 will also outline the theoretical framework for conducting the study around the research questions. Chapter 3 will proceed to describe the methodology employed in this research including the research design, data collection measures, and data analysis process. Chapter 4 outlines the results and findings for the study from the data that was collected and analyzed. Chapter 5 provides a cross-case analysis, followed by conclusions and discussion of findings. Chapter 5 also provides implications of this work and suggestions for conducting future research in this area of study.

CHAPTER 2: REVIEW OF THE RESEARCH LITERATURE

Often the many challenges that new teachers face can feel insurmountable, and as a result, teachers become disillusioned with the profession and leave too soon (Kurtts & Levin, 2000). Additionally, new teachers face increasing pressure to engage all children in the development of complex skills and are expected to prepare each student, regardless of their socioeconomic status, English proficiency, or lack of ability for higher order thinking skills (Bransford, Darling-Hammond, LePage, 2005) and adjust to the changing needs of students in a world of rapid social, cultural, economic and technological change, which place new demands on teachers (European Commission, 2009). This chapter provides a review of the literature that lays foundation for the study. I begin by presenting literature on the importance of induction programs. This is then followed by discussion on reflective practice, teacher beliefs and teacher identity which are significant for this study. Following this review of the literature I present the theoretical framework that guided this study.

What is Induction and Why Induction Is Important

Recruitment and retention of high-quality teachers are viewed as important challenges for public education in the United States (Kelley, 2004). According to the National Commission on Teaching and America's Future (2003), the attrition rate of teachers has increased faster than the supply of teachers. In particular, the group of greatest concern in the area of teacher attrition is beginning teachers. Ingersoll (2001) in his analysis of the national Schools and Staffing Survey and Teacher Follow-Up Survey found that more than a third of beginning teachers leave the profession during the first 3 years, and almost half leave after 5 years. Teacher attrition — teachers leaving teaching

— is especially high in the first years on the job. Several studies (Ingersoll, 2003; Ingersoll & Perda, 2010), have estimated that between 40% and 50% of new teachers leave within the first five years of entry into teaching. Moreover, Ingersoll (2012) found that the attrition rates of first-year teachers have increased by about one-third in the past two decades. It is not only that there are far more beginners in the teaching force, but these beginners are less likely to stay in teaching. Ingersoll et al. (2014) points out that one of the pivotal causes of inadequate student performance, especially in mathematics and science, is the inability of schools to adequately staff classrooms with qualified teachers as a result of teacher shortages. In short, both the number and instability of beginning teachers have been increasing in recent years.

Beginning teachers face a wide array of challenges during the start of their careers, including implementing inquiry-based teaching while they become members of their teacher communities (Goldrick, Zabala, & Burn, 2013; Luft et al., 2011) and induction programs have been proposed as an effective way to support beginning teachers in teaching their discipline to all students (Liston, Whitcomb, & Borko, 2006). Induction is a process - a comprehensive, coherent, and sustained professional development process – that is organized by a school district to train, support, and retain new teachers and seamlessly progresses them into a lifelong learning program (Wong, 2004). Teacher induction programs offer assistance, guidance, and support to new teachers. Although the most common component of induction programs is mentoring (Ingersoll, 2007; Ingersoll & Smith, 2004) other components include orientation, workshops, distribution of written materials, classroom observation, and reduced workloads.

Historically, the education profession has ignored the support needs of its new recruits and has been described as “the profession that eats its young” (Halford, as cited in Renard, 1999, p. 227). The need for induction programs arises from the difficulties encountered by new teachers in their transition from being students of teaching to teachers of students (e.g., Kelchtermans & Ballet, 2002; Veenman, 1984). The induction phase has been depicted as a complex interaction of personal and situational factors through which new teachers negotiate professional and organizational socialization (Zeichner & Tabachnik, 1985). This phase of becoming a teacher is not just about anxiety, stress, and frustration; rather, it is an important learning stage in which teachers expand their content-specific repertoire of teaching strategies, acquire important practical knowledge related to students, curricula, workplace norms, and school policies, test their beliefs and ideas about teaching, and mold their professional identity (Feiman-Nemser et al., 1999; Kelchtermans & Ballet, 2002; Wayne et al., 2005).

While Ingersoll (2003) found that about 50% of teachers leave within five years of their teaching careers, Goldrick, Osta, Barlin, and Burn (2012) reported that there is an increasing influx of beginning teachers in today’s classrooms. As a result of which, schools are confronted with the phenomenon of a “revolving door” (Smith & Ingersoll, 2004, p. 706) in terms of their staffing situations. In particular, a shortage of teachers in the field of science and mathematics is evident when considering the supply of new teachers—when balanced against the losses of teachers—due to retirement, pre-retirement teacher turnover, and other factors (Ingersoll & Perda, 2009). Ingersoll and Merrill (2013) in their recent report indicated that the teaching community is getting greener while becoming less stable in terms of teacher turnover. These trends are partially

due to the increasing size of the teaching force, as well as the increasing rate of teachers leaving the profession. Overall, teacher turnover from retirement, by itself is considered a relatively minor factor (Avraamidou, 2014). Rather, the elements of a school's overall environment, its differences, characteristics, and other conditions are considered as major factors—as they pertain to retention—especially for beginning teachers (Ingersoll & Perda, 2009; Smith & Ingersoll, 2004).

Beginning teachers who are given multiple induction supports are less likely to move to other schools and less likely to leave teaching (e.g., Johnson, Clift, & Klecka, 2002; Ingersoll & Smith, 2004). Moreover, data exist which show that induction programs can contribute to high levels of professional growth (e.g., Fletcher & Barret, 2004, Kelley, 2004). Although these programs vary across countries as well as within countries (Howe, 2006; Wayne, Young, & Fleischman, 2005; Wong et al., 2005), induction programs have been shown to successfully influence teacher effectiveness and retention. When new teachers experience a lack of support and poor working conditions, their commitment to stay in the profession weakens. These new teachers need opportunities to collaborate with other teachers in professional communities, observe colleagues' classrooms, be observed by expert mentors, analyze their own practice, and network with other novice teachers (Darling-Hammond & Sclan, 1996; Elmore, 2002). By receiving the attention and guidance that is important to novice teacher growth, these teachers can improve in their instructional practices and are more likely to stay in the profession.

Sanford (1988), in describing the lack of content-specific or grade-level specific studies concerning teacher induction, commented on the tendency to group mathematics

and science teachers together. He concluded that beginning science teachers frequently face a more diverse curriculum, must prepare for multiple science disciplines, and have considerably more content and teaching strategies to select from than their mathematics counterparts. Luft and Patterson (2002) developed a one-year science-specific induction program to connect theory with practice for beginning science teachers. They found that “75% of the participating teachers [felt that] the program [had] significantly challenged their ideologies about teaching science” (p. 278). Luft et al. (2011), in a two-year study, found that science-specific induction and mentoring emphasized student-centered frames of mind, which is important for inquiry-based instruction, led to teachers’ developing more student-centered beliefs about teaching and learning. In contrast, teachers who did not receive science-specific induction and mentoring did not experience changes in their beliefs. Luft, Roehrig, and Patterson (2003) examined the impact of three different induction programs on the teaching beliefs, practices, and experiences of beginning secondary science teachers. The teachers were matched by grade level among three groups; one group participated in a science-focused support program, another participated in a general support program, and a third had no formal support. The findings suggest that the beliefs and practices of beginning science teachers are subject to change, there is a relation between beliefs and practices, and that an induction program in science may reinforce beliefs and practices toward more standards-based instructional models. Given that it is critical that teachers develop skills of reflective practice to facilitate their continued growth following the high support structure of the induction period, this research aims at contributing to the literature base.

Effective Induction

Induction is an education reform that can help retain teachers and improve their instruction. Effective induction is a systematic process embedded in a healthy school climate that meets new teachers' personal and professional needs. Personal needs are of the psychological domain, including self-reliance, self-esteem, and self-efficacy (Gold, 1996) while professional needs encompass technical, collegial, and reflective practices, as they are perceived by the new teacher and the school community (Wang & Odell, 2002). The research related to effective induction focuses primarily on the use of one to one mentors in transitioning novice teachers into professional practice rather than programs of support that encompass several components (Darling-Hammond, 2003; Feiman-Nemser, 2003; Gold, 1996). In a study conducted by Bickmore & Bickmore (2010) to determine the implementation and effectiveness of the components of two middle school induction programs, they concluded that climate is paramount in the effective induction of new teachers (Williams et al., 2001). Of specific importance is the collaboration and affiliation experienced by new and experienced teachers that provided a culture of professional learning that focused on student outcomes.

Teacher preparation programs are not able to fully prepare teachers for the realities of the classroom as learning continues during the critical induction period (Feiman-Nemser, 2001; Ganser, 2002). Indeed, teachers' identity continues to develop throughout the early years in the classroom (Chang-Kredl & Kingsley, 2014). Thus, this study uses a framework of evolving teacher identity to explore the teachers' development in terms of their classroom roles and responsibilities, the ways they think of and describe themselves as professionals through reflective practice, and their beliefs and practices

about their classroom teaching and student learning. In the following sections, relevant literature on reflective practice, teaching beliefs, and teacher identity is presented as background information for the teacher identity framework used in this study.

Reflective Practice

Reflective practice is widely recognized as a central component of the teaching and learning process (Brookfield, 1995, 2005). Beginning teachers face a wide array of challenges during the start of their careers and providing spaces for them to reflect on their practice is critical to their professional growth (Ellis, McFadden, Anwar & Roehrig, 2015). Lupinski et al. (2012) points out that reflection could be a rich source of continued personal and professional growth, which provides an opportunity for professionals to renew and revive their practice. When a teacher engages in meaningful reflection, conclusions can be drawn that provide insight for future instruction where the primary emphasis is to prepare them to create learning environments that are conducive to the teaching and learning process which will positively impact student achievement.

Despite the increase in the recent interest in reflective practice, it remains somewhat difficult to define concisely. Schön (1983, 1987) viewed reflective practice as distinct from the type of practice where one is engaging in spontaneous and routinized actions. In his view, reflective practice necessitates that one respond to an unexpected problem or outcome during which s/he uses prior experiences and creative problem solving to develop strategies or actions that may address the problem or situation. Farrell (2015) defines reflective practice as “a cognitive process accompanied by a set of attitudes in which teachers systematically collect data about their practice, and, while engaging in dialogue with others, use the data to make informed decisions about their

practice both inside and outside the classroom” (p. 123). Richardson (1996) describes reflective teaching as a transfer from the ordinary to higher level awareness of teaching practice. Pollard and Tann (1989) describe reflective teaching as a systematic process of investigating teachers own practice. Hubball, Collins and Pratt (2005, p. 60) define reflective practice as the thoughtful consideration and questioning of what we do, what works and what does not, and what premises and rationales underlie our teaching and that of others. Zahvi (2006) characterises reflection as higher-order monitoring and defines it as the process whereby consciousness directs its intentional aim at itself, thereby taking itself as its own object. Osterman and Kottkamp (2004), in their turn, describe reflection as a professional development strategy that can equip professionals with “opportunities to explore, articulate and represent their own ideas and knowledge” (p.70). Therefore, McAlpine and Weston (2000) argue that reflection is helpful in fostering professional growth. On the other hand, Dewey asserts that the purpose of reflective practice is to direct the teacher in taking actions and making decisions. He adds that reflection is a holistic orientation to teaching that can be helped to acquire, rather than a procedure that can be taught (Zeichner & Liston, 1996). For the purpose of this study, I used the definition by Hubball, Collins and Pratt (2005) for reflective practice which is considered as a thoughtful deliberation of what practices work in the classroom that enables teachers to strengthen their practice and enhance students’ learning.

Teacher reflection is critical in teacher change. The act of reflecting on beliefs and behaviors allows teachers to make connections between their thoughts and actions and to recognize, expose, and confront contradictions and inconsistencies (Hart, 2002). Reflective practice thus enables teachers to realize the influence of their beliefs on the

instructional decisions they make while teaching. When encouraged to articulate and reflect on their beliefs, inservice teachers have also reported some revaluations as a result of the greater awareness. Senior (2006) has observed that many teachers “do not have the inclination to sit down and reflect on the reasons that underlie their classroom decision making” (p. 247). Knezedive (2001) pointed out that developing this is important, because it is the beginning of a “process of reducing the discrepancy between what we do and what we think we do” (p. 10). There is ample evidence of the powerful influence of science teachers' attitudes and beliefs on teaching science, and by helping teachers understand their beliefs, we can develop more reflective teachers who can not only grow professionally but who can also promote awareness and growth in their students.

Reflection can be a systematic and purposeful methodology to examine ones' teaching practice (Deaton, 2012). Schön (1983) identified two types of reflection: reflection-on-action and reflection-in-action. In reflection-on-action, teachers review, describe, analyze and evaluate their past practices with a view to gaining insight to improve future practice. During reflection-in-action, teachers examine and respond to events as they occur in real time. In both types of reflection, professionals seek to build new understandings that shape their actions in the unfolding situation. Killion and Todnem (1991) added another category of reflection to Schön's model: 'reflection-for-action' that occurs before beginning the task. Reflection-for-action provides for a deeper focus on lesson planning, which is an important learning space for beginning teachers. In order to systematically reflect on their teaching using evidence, tools such as journals, video recordings of classroom teachings serve effectively to help them reflect on their teaching practice by observing, examining, and evaluating their teaching (Abell et al., 1996; Davies, 2000;

Ratcliffe et al., 2003). These types of tools support teachers in participating in reflection-on-action (Schön, 1987), where teachers critically examine issues of practice while taking time to step outside their teaching situation. Dewey (1933) and Rodgers (2002) stated that the primary objective of reflection on action is to promote the more difficult reflection in action. When teachers view a video of themselves teaching, it provokes memory of a previous experience and provides opportunities for analysis and deliberation of possible future actions (Ellis, McFadden, Anwar & Roehrig, 2015). In this study, reflection through conversations about practice and video will be used as a vehicle to engage teachers in order to help them identify their development and practices as a beginning teacher.

Teachers' Beliefs

Teacher beliefs have a huge impact on educational achievements and is an important factor for both the promotion of learning and motivation. Beliefs influence how individuals view the world and the decisions that they make. These beliefs “play a major role in defining teaching tasks and organizing the knowledge and information relevant to those tasks” (Nespor, 1987, p. 324). However, Kagan (1992) stated that teachers’ knowledge and beliefs are often implicit: “Teachers are often unaware of their own beliefs, they do not always possess language with which to describe and label their beliefs, and they may be reluctant to espouse them publicly” (p. 66). Kagan (1992) added that beliefs are “a particularly provocative form of personal knowledge that is generally defined as pre- or in-service teachers’ implicit assumptions about students” (p. 65).

Science teachers, like all teachers, possess beliefs about teaching and learning that influence their behavior and practice. One factor that may influence teachers’ classroom

practices, and hence student outcomes, is the beliefs they hold about teaching and learning (Roehrig et al., 2009). Teacher beliefs can influence the way knowledge is acquired, the students' actions, as well as students' ways of thinking and behaving (Borg, 2001). Studies have shown that teacher beliefs, which can be defined as the way they conceptualize their work in the classroom in relation to student learning (Richards, Gallo, & Renandya, 2001), have an impact on their classroom practices in science and mathematics (Ernest, 1989; Lumpe, Czerniak, Haney, & Beltyukova, 2012; Roehrig & Luft, 2004).

Beliefs and experiences. According to Jones and Leagon (2014), teachers' perceptions and beliefs about science teaching are established and nurtured through their own experiences as learners. Nespor (1987) stated that beliefs “are important influences on the ways [individuals] conceptualize tasks and learn from experiences” (p. 317). Experience is an important factor affecting belief (Ročāne, 2015). Beliefs are said to be formed by positive or negative personal learning experiences, as well as the positive or negative opinions of others - an encouragement to successful performance in future (Österholm, 2009). Ročāne (2015) points out that the gained belief can contribute to the professional achievements in future. An additional motivating factor is the positive feedback of others - school administration, colleagues, students, parents.

Beliefs about teaching and learning. Studies on teacher professional development have examined the changes in beliefs of beginning and practicing teachers. Luft (2001) found that beginning science teachers were more likely to change their beliefs about teaching science as compared to their more experienced peers, whose beliefs were found to be more static over time. Luft's findings are in accordance with

those of Simmons et al. (1999), who, in a study of 114 science teachers, found that novice teachers' beliefs were more malleable when compared to those of more experienced teachers. Teachers in the beginning phase of their career are still negotiating, within the school context, their role as a science teacher (Henry, Bastian, & Fortner, 2012; Luft, 2001). When encouraged to articulate and reflect on their beliefs, inservice teachers have also reported some revaluations as a result of the greater awareness. For example, Borg (2011a, p. 378), found that, in many cases, inservice teachers "progressed from an initial stage of limited awareness of their beliefs to feeling quite strongly that they were aware of and could articulate key beliefs underpinning their work." The process of reflection included coursework, teaching practice and feedback, and reflective writing. Borg (2011b) reported that, for many teachers, such reflections resulted in their beliefs being "strengthened and extended ... and they can learn how to put their beliefs into practice and also develop links between their beliefs and theory" (p. 378).

Beliefs and practices. Beliefs are an important component and have strong implications for providing instructions. Richardson (1996) points out that there is a clear relationship between beliefs and teaching practices, which suggests that teachers' beliefs toward a given subject, their attitudes toward their students, and how they believe students learn all affect their subsequent actions in the classroom. Nespor (1987) further explains the role of teacher beliefs in making instructional decisions. Nespor posits that belief systems are very important in determining how an individual organizes their world into task environments and defines tasks and problems. In the case of teachers and their instructional responsibilities, an individual's beliefs will greatly influence how they prioritize the tasks at hand and what steps they take to address them. Teachers' beliefs

shape their planning and the curricular decisions they make, in effect determining what should be taught and what path instruction should follow.

Teacher Identity

Research indicates that there has been little attention to teachers' beliefs about their ability to support the learning needs of all children and the likely consequences their teaching might produce (eg. Settlage, Southerland, Smith & Ceglie, 2009). This has led to widespread interest in teacher identity in studying how teachers work, learn and develop (Alsup, 2006; Beijaard, Meijer, & Verloop, 2004). Although the concept of identity has been extensively argued in earlier studies, a single definition of identity is lacking. Even though researchers often provide a definition of identity, they generally define identity by focusing on different aspects due to the fluid and dynamic nature and semantic broadness of identity as a construct. For example, Avraamidou (2014) points out that "identity" is a kind of umbrella term, attached to various internal and external factors such as self, emotion, context, lived experiences and social interaction. And for this reason, researchers are inclined to make assumptions about different characteristics of identity in order to facilitate their understanding of this concept rather than giving an exact definition. One of the common assumptions is identity has strong ties to the notion of self, and is greatly influenced by context (Avraamidou, 2014; Beauchamp & Thomas, 2009).

Teacher professional identity has remained difficult to conceptualize (Beauchamp & Thomas, 2009; Beijaard, Meijer, & Verloop, 2004), and researchers conceptualize identity in a variety of different ways depending upon their philosophical perspective and analytic lens or framework through which they examine aspects of identity. In most of

the studies, identity is defined as referring to teachers' notion of self (Knowles, 1992), social context (Gee, 2001) interpretation of personal stories (Connelly & Clandinin, 1999), teachers' roles (Volkman & Anderson, 1998) and teacher narrative and discourse (Rodgers and Scott, 2008).

Beijaard, Meijer, and Verloop (2004) treat teacher identity as developing during an entire career. Rodgers and Scott (2008) define identity considering its link to self by an analogy in which identity refers to "stories" or "meaning made" and self represents "meaning maker" or "story tellers" (p. 738–739). From a sociocultural perspective, Olsen (2008) considers identity as a label for the collection of influences and effects from immediate contexts, prior constructs of self, social positioning, and meaning systems (each itself a fluid influence, and all together an ever-changing construct) that become intertwined inside the flow of activity as teacher simultaneously reacts to and negotiates given contexts and human relationship at given moments. (p. 139). In the words of Rodgers and Scott (2008), teacher identity is a shifting framework of understanding formed by multiple relationships and takes different versions depending on social, cultural, political and cultural contexts. Britzman (2003) also highlights similar features of identity: its multiple determinations influenced and shaped by contextual factors. Kress, 2011 suggests that "teacher identity is not simply who teachers think they are," (p.8) and "teacher identity is hard to articulate, easily misunderstood and open to interpretation" (Olsen, 2008, p. 4). Although researchers conceptualize identity in different ways, they agree that identity is a dynamic, multifaceted, and evolving concept that is influenced deeply by social context and personal experiences. Gee (2001) illustrates this well in writing: "The kind of person one is recognized as being, at a given

time and place, can change from moment to moment in the interaction, can change from context to context, and of course, can be ambiguous or unstable” (p. 99).

Role of reflection in shaping teacher identity. Reflection is a factor in the shaping of identity. Reflection is recognized as “a key means by which teachers can become more in tune with their sense of self and with a deep understanding of how this self fits into a larger context which involves others” (Beauchamp & Thomas, 2009). Therefore, when considering identity in beginning teachers, the notion of reflection must be included, as it is central to their development. Researchers agree that probing their teaching existence is important for teachers to understand their position within their practice (Beauchamp & Thomas, 2009). According to Conway (2001), while reflection requires a looking back at thoughts or practices, considering their value or effectiveness is the idea that reflection might be anticipatory or prospective. Reflection also enables one to look ahead at a future practice or a future way of thinking that could inform teacher development. It continues to be acknowledged as a powerful way for teachers to delve deeply into their teaching identities.

Identity as a Lens for Becoming a Reform-Minded Science Teacher. Identity refers to the way in which an individual perceives of themselves and is perceived by others (Gee, 2003). The development of a teacher’s identity is a multifaceted ongoing process, as the formation of a teacher identity develops within social, organizational, and socio-historical circumstances (Varelas, House, & Wenzel, 2005). To become a teacher is a continual act of forming and reforming oneself within an elaborate web of affiliational, institutional, discursive settings and natural elements. Thus, the moment-to-moment interactions with students, the day-to-day relationships with peers, and the year-to-year

shifts in responsibilities all have the potential for shifting the path of a teacher's identity (Settlage et al., 2009). The identities teachers develop "shape their dispositions, where they place their effort, whether and how they seek out professional development opportunities, and what obligations they see as intrinsic to their role" (Hammerness et al., 2005, p. 384).

Research suggests that beginning teachers go through a process of "becoming" that emerges through social historical transactions involving ongoing identity-related negotiations, conflicts, and exploration (Schutz, Nichols, & Schwenke, 2018). Teachers who struggle to understand their role and place in the classroom are more likely to burn out and leave; whereas teachers who are more successful in understanding and adjusting their identities as teachers might be more willing to persevere.

Teachers' sense of identity has been shown to play a key position in their understanding of their own actions (Kelchtermans, 2005). In short, a greater understanding of their own identities can assist teachers as they face many of the challenges in their careers. An individual's identity is much more than what a person chooses to portray. The stories we tell about ourselves create our narrated identity, whereas the stories others tell about us create our designated identities (Sfard & Prusak, 2005). Our designated identities emerge as others recognize and interpret our thinking, activities, associations, and utterances. The ongoing identity development narratives revolve around teachers' goals, standards, and beliefs, the perceived constraints and affordances within their current activity setting, and influences that emerge within their social historical contexts.

Identity Development.

Identity development is being seen as a highly complex, discontinuous, multi-faceted and nonlinear process of interaction between individuals and their various social and professional environments (Akkerman & Meijer, 2011). While identity is continually reshaped over the life of an individual, a teacher's professional identity has become a useful construct for understanding development throughout the professional life of teachers. Researchers have identified professional identity as an ongoing process of integration of the "personal" and the "professional" sides of becoming and being a teacher (Bejarad, Meijer & Verloop (2004). A teacher's professional identity is not a fixed property and is instead a dynamic process which is socially situated and is differentiated from a teacher's role (Olsen, 2011). Flores & Day (2006) define professional identity as "an ongoing and dynamic process which entails the making sense and (re)interpretation of one's own values and experiences" that may be influenced by personal, social and cognitive factors" (p.220).

The literature indicates that past experiences affect teacher identity, which then modulates their pedagogical choices (Eick and Reed 2002; Rex and Nelson 2004). Thus, teachers' identities are shaped by experiences (Proweller and Mitchener 2004), and teachers' identities affect their experiences as their identities influence their instructional practice (Keiler, 2018). Cohen (2010) points out that teachers' talk about and experience of professional identity is "central to the beliefs, values, and practices that guide their engagement, commitment, and actions in and out of the classroom" (p. 80).

The Dimensions of Teacher Identity

Teachers' identities are central to their beliefs, values and practices that guide their actions within and outside the classroom (Walkington, 2005), while their professional identities come from their interpretation of their experiences (Geijsel & Meijers, 2005). Akkerman & Meijer (2011) point out that there are several recurring characterizations of teacher identity, of which the most commonly seen are related to: (a) the multiplicity of identity, (b) the discontinuity of identity, and (c) the social nature of identity. These three characterizations stress that identity is not a fixed and stable entity, but rather they shift with time and context. Considering the characterization of multiplicity in literature, we see that this notion seems to be commonly accepted. For example, Day, Sammons, Stobart, Kington, and Gu (2007) distinguished three 'dimensions of identity' (p. 106): professional identity, situated identity, and personal identity while Beijaard et al. (2000) described teacher identity as consisting of three sub-identities: the teacher as a subject matter expert, pedagogical expert, and didactical expert. Beijaard et al. (2004) derived four essential features of teachers' professional identities. (1) Professional identity is an ongoing process that involves adjustments along the way; (2) Professional identity is closely connected to context; (3) Professional identity consists of sub-identities that more or less harmonize; and (4) Agency plays a significant part in professional identity formation. Beijaard et al. (2004) conclude that while professional identity implies both person and context, teachers' professional identity consists of sub-identities relating to teachers' different contexts and relationships.

Researchers describe identity as being fluid and shifting from time to time and context to context. In relation to the notion of discontinuity, Palmer (1998) stated that

“identity is a moving intersection of the inner and outer forces that make me who I am” (p.13). Beijaard et al. (2004) consider identity to be an unstable concept and argue that identity formation includes responses to two questions: “Who am I at this moment?” and “Who do I want to become?” Danielewicz (2001) concluded that “every person is composed of multiple, often conflicting, identities, which exist in volatile states of construction or reconstruction, reformation or erosion, addition, or expansion” (p.10) and indicated change as most characteristic about selves and identities.

Professional Identity: An Ongoing Process of Interpretation and Reinterpretation of Experiences

Thomas & Beauchamp (2011) presume that the process of envisioning the self as a professional is a crucial stage in the development of an effective teacher identity. Professional identity can be considered as one component of multiple perspectives of a person’s identity, the component associated with their professional status as a teacher (Gee, 2001). Professional identity is not only the ongoing process of a teacher educator continually relying on (and adapting) his or her self-understandings to make meaning out of present experience but is also the resulting, dynamic product of knowledge, goals, and self-understanding that is enacted in (and shaped by) everyday practice (Olsen & Buchanan, 2017). In the literature, teachers’ professional identity can be traced into three categories of studies, based on the focus on different aspects: (1) teachers’ professional identity formation and development; (2) identification of characteristic of teachers’ professional identity, and (3) professional identity (re)presented by teachers’ stories.

Pennington (2002) points out that teacher identity can be studied in two different orientations: the first originates from social psychology and provides perspectives on

teachers' social identities, while the second results from the teacher education literature and provides perspectives on teachers' professional identities. For Pennington, both of these orientations can serve as a basis for a consideration of teacher identity. Sachs (2005) defines professional teacher identity as standing at the core of the teaching profession. It provides a framework for teachers to construct their own ideas of "how to be", "how to act" and "how to understand their work and their place in society" (Sachs, 2005, p. 15). Importantly, teacher identity is not something that is fixed nor is it imposed; rather, it is negotiated through experience and the sense that is made of that experience. The elements of professional identity listed as "how to be, act" and "understand" compose not only the occupational identity of teachers, but their personal identity as well. This view also emphasizes that identity cannot be taught or acquired because it is innate and the only source of change is experience.

Teacher identity is considered a dynamic, continually changing, and active process which develops over time through interaction with different policy, school, and classroom environments and those who work in them (Watson, 2006). Davis et al. (2006) argue that teachers' personal histories and professional experiences influence their professional identity development. While teachers' experiences are central to their identity development, these experiences are processed within a particular context and influenced by a community of practice (Freedmann & Applement 2008; van den Berg 2002; van Huizen et al. 2005). When considering the notion of the social nature of identity, Flores and Day (2006) reported a strong interaction between personal histories of novice teachers and the contextual influences of the workplace in influencing the shaping and reshaping of these teachers' identities. Hence, in developing identities,

interpreting and constructing stories that others tell as well as stories one tells oneself are important.

Theoretical Framework

Integrating the concept of reflection and identity, the development of these beginning teachers is viewed as an ongoing and overlapping process as shown in Figure 2.1. This proposed framework which is modified from Beauchamp & Thomas (2006), suggests that as beginning teachers take up the profession as a teacher, they come into it with past experiences as learners. Two points of possible intervention in their development as teachers enable them to transform the student identity into a professional identity as teachers. The first comes from the opportunities that they receive during their teacher education experiences, where their beliefs about teaching and learning is implemented and evolved continuously. The second comes during their initial practice as teachers, where their experiences provide them opportunities for reflection on their own practice and beliefs as a teacher - this time, within the influence of the school context. As these beginning teachers move from their experiences as students to real practice, they will undergo a shift in their identity as they adjust to an actual school context. This shift in their professional identity involves seeing themselves as practitioners rather than students. Hence, the development of identity in teachers can therefore be seen in three phases: the student identity they begin with, an identity in transition as they move toward and into practice, and a professional identity that results from the experience of both teacher education and initial practice which is shown in Figure 2.1.

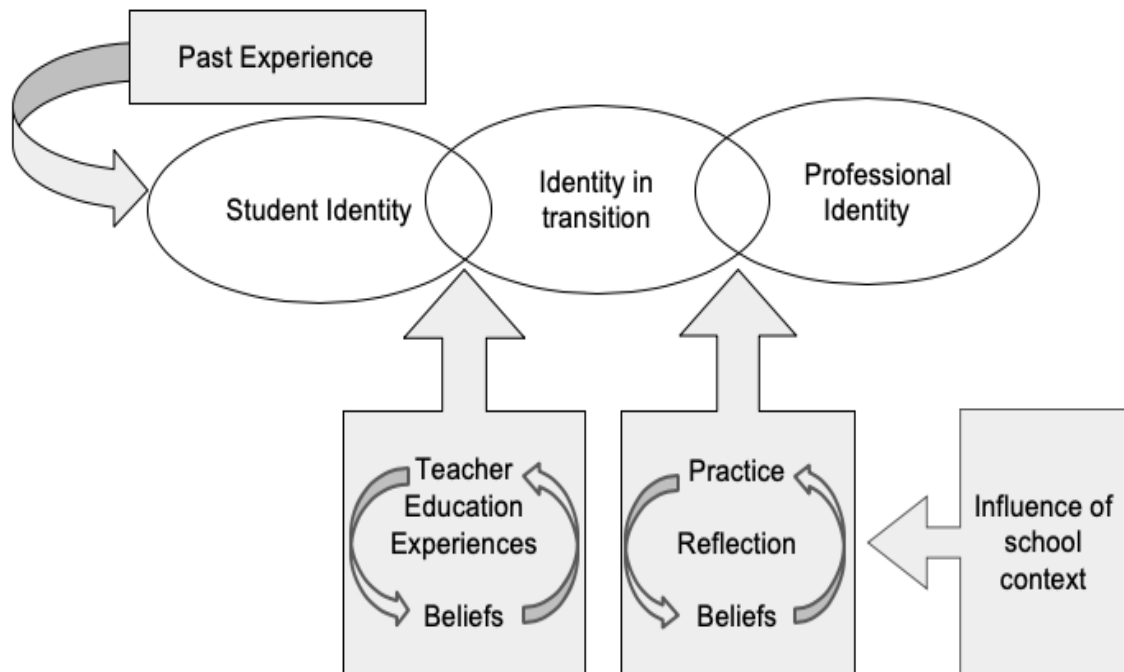


Figure 2.1. Development of professional identity in teachers (modified from Beauchamp & Thomas, 2006).

Teachers experience many opportunities to both change themselves, and to be changed by the influences around them. The students they teach, the preservice preparation and in-service professional development they receive and sometimes the profession of teaching as a whole are important factors in shaping their identity (Botha & Onwu, 2013). Using the above framework (Figure 2.1) to identify teacher's beliefs and practices, their professional identity could be seen as one that is constantly changing, and evolving based on their personal and professional experience. Hence, articulating their beliefs and practices about teaching through reflection can be a powerful way to understand themselves better in terms of the school context they work in.

CHAPTER 3: METHODOLOGY

This chapter presents the research design employed in the study. The overarching goal was to understand the developing identities of the participating science teachers. In the process of identifying who they are as a teacher, they engaged in reflection which mediated that transition as they reflected on their beliefs and practices in the first few years of their career. The research questions that guided this study are:

- 1) How do beginning secondary science teachers' professional identities develop over their first three years in the classroom?
 - a) How does their reflection on their beliefs and practices mediate that transition?

Research Design

The research design employed is an exploratory multiple case study (Yin, 2014). The study was contextualized within the project **Promoting Reflective and Equitable Practice through Science Induction (PREPS*ci*, NSF-DUE 1540789)**. Each of the three participating teachers constitute the individual cases. This case study design was appropriate for this study due to its intent to explore how teachers in high need schools identity themselves as beginning teachers with regard to their beliefs and practices towards teaching. Stake (2000) argues that the first criterion for choosing a case is the concern to maximize what we can learn. The participants in this study were selected based on the completeness of the data and purposefully sampled to focus on teachers working and learning to teach in high need schools. High need schools are characterized by low student performance, high levels of ethnic minorities, immigrants, mobility,

homeless families, children in foster care, incarcerated students, drug abuse, and English Language Learners (Duke, 2008, 2012).

This qualitative research was conducted in the form of a multiple case study of three teachers in order to understand how they identify themselves as beginning teachers with respect to their new role as classroom teachers and their development of beliefs and practices toward science teaching, thereby enabling them to identify areas that they see having developed in the first three years as a science teacher. Multiple data sources were used in this study to gain a comprehensive understanding of the development of teachers' identities (Bogdan & Biklen, 2007), to allow cross validity checks (Patton, 2002), and to enable triangulation of findings (Howe & Stubbs, 2003).

Context and Participants

The participants in this study are three teachers working in high need schools who were selected from a pool of first-year secondary science (grades 9-12) teachers from urban, Midwestern school districts in the U.S and who also participated in the PREPSci project. The focus of the larger project was on improving the induction experiences of beginning secondary science teachers working in high-need schools.

Prior to starting teaching, the participants were students at a Midwestern university, entering the M.Ed. program as a cohort who completed a year-long initial licensure program that included a three-course science methods sequence, coursework on the nature of science, and extensive school-based practice, in addition to foundations coursework. Following completion of the licensure program, they were required to take an additional nine credits which included an online induction course focused on improving reform-based teaching through ongoing reflective practice, a face-to-face

course on equity and social justice, and an online action research course. The online induction course was offered for these beginning secondary science and mathematics teachers to best support their professional growth and develop reflective, reformed based practices. The description of the courses is provided in Table 3.1

Table 3.1 *Description of the courses*

Courses	Description
Online Induction Course	To support professional growth and develop reflective, reformed based practices-includes Individual reflective journals, Vexation and Venture, Professional development inquiries and Video clubs
Equity and Social Justice Course	To improve teachers' understanding of culturally responsive pedagogy (CRP); sociopolitical awareness and knowledge of their cultural identities- includes reflection and discussion on Culture and Learning, Developing affirming views, Funds of Knowledge, Critical Consciousness and Curriculum Writing
Action Research Course	To develop and craft action research plan- teachers taking a reflective practitioner stance in which they identify and respond to problems of practice through the systematic examination of these problems.

Participants

An overview of the three teachers is provided in Table 3.2 followed by a brief description of each participant and their teaching context.

Table 3.2 *Teacher Demographics* (*all names are pseudonyms)

Teacher*	Gender	Years teaching	School context Grade band	Discipline(s) taught
Alex	M	4	Urban High School	Chemistry/Chemical Science Physics/Physical Science
Sue	F	4	Urban High School Middle School	Biology Chemistry/Chemical Science Physics/Physical Science
Anto	M	4	Suburban High School	Biology Physics/Chemistry

Alex:

Teaching is a second-career for Alex. He tried out a few different paths, from a professional water-skiing career to a brief stint in medical school. He worked as a chemist for 7 years, after which he decided to meld his love of science with his passion for working with youth.

Alex is a 9th grade Physical Science teacher at Noether High School. Noether is a high-need urban school with a 91% of African-American student population. Only 4.8% of students were proficient in reading, 11.4% of students were proficient in science, and 8% of students were proficient in mathematics in 2018 (Minnesota Report Card, 2018). In addition to teaching physical science, Alex is also an assistant football coach and the science department lead in his third year of teaching at the school. While describing

Noether as a high need school, Alex informed that he found out recently that at Noether, the average incoming freshmen students are four to five grade levels behind in reading, writing and math.

Sue:

Sue started her teaching career at Oxford Learning Center right after completing her degree. She was the only science teacher at her school who taught seventh graders and ninth graders biology. Sue completed her student teaching at Oxford before starting there as a full time teacher. She was hired as her co-operating teacher went on leave for a full year. Oxford Learning Center included 17% Hispanic or Latino students, 1% American Indian or Alaska native students, 12% Asian students, 9% African-American students, 55% White students and 5 % two or more races and 34.4% of students receive a free or reduced price lunch (Minnesota Report Card, 2018). After completing a year at Oxford school, Sue moved to Morgan Middle School. Morgan is a high need, urban school with 35% African American students, 17% Asian students, 9% Hispanic or Latino students, 37% White students and 2% American Indian students (Minnesota Report Card, 2018), of which 58.5% have access to free and reduced lunch. At Morgan, she taught seventh grade life science and astronomy for seventh and eighth graders and is currently teaching sixth grade physical science and an astronomy elective.

Anto:

Anto is a fourth year teacher at Kings Academy, an alternative high school which serves 32 students in grades 10 and 12. This has been his first teaching job and he has been teaching Biology which is his main content area. Apart from teaching biology, he also taught physics and chemistry. In one of his statements, Anto shared that the students

enrolled at Kings academy are “high risk who could not function in the mainstream high school as they need a smaller setting.” Kings Academy was placed in the bottom 50% of all schools in a Midwestern state for overall test scores for the 2016-17 school year. The student body makeup is 62 % male and 38 % female, and the total minority enrollment is 28 percent.

Data Sources

Data was collected from multiple sources, including classroom observations, interviews and reflective journals (see Figure 3.1).

Data Collection Timeline									
Year 1			Year 2			Year 3			Year 4
Fall 2015	Spring 2016	Summer 2016	Fall 2016	Spring 2017	Summer 2017	Fall 2017	Spring 2018	Summer 2018	Summer 2019
Induction Program Artifacts (Reflective Writing Prompts)									
Teacher Beliefs Interviews (TBI)									
Classroom observations and artifacts (video, audio, field notes) - when available throughout the year									
							Stimulated Reflection Interview		
									End of Year Interview

Figure 3.1. Data collection timeline and sources for the project over the course of four years

Classroom observations and post-observation interviews. The teachers were observed at least once per semester, with a total of three observations each academic year and nine observations throughout the course of three years. The observations were scheduled up to a week or two in advance with the teacher deciding on the class and lesson to be observed. Classroom observations were videotaped allowing for two levels of analysis: one from the researcher's perspective and the other from the participating teacher's perspective. First, this permitted analysis in order to develop a research-based narrative of the development of teaching practices over time. This analysis was supported by the post-observation interviews that allow for connections to be made between actual classroom practices and intended practices tied to beliefs. The post-observation questions asked were: (1) Tell me what you thought about the lesson I observed. How did it go? What parts would you definitely keep? Were there any parts you'd change if you could? Why? (2) I'd like you to think about what it means to you to teach "inquiry-based science." Can you describe how inquiry-based science looks in your classroom? (3) How would you describe your role as a teacher, and how do you think it has changed in the last few years? Second, video of classroom instruction provided opportunities for reflective practice by the beginning teacher, adding their voice into the analysis.

Teacher Beliefs Interviews (TBIs). Teacher Beliefs Interviews (Luft & Roehrig, 2007) were conducted once a semester regarding their experience, to gain insight into their changing knowledge and practices, and to inquire further about their approaches to teaching and student learning. As Corbin and Strauss (2008) state, "the interview process provides participants an opportunity to talk in depth about issues that they hadn't talked much about before, giving them insights into their own behavior" (p. 28), and the

interview questions that were constructed aimed to uncover teachers' decisions regarding their classroom practice. The responses to TBI questions were then transcribed verbatim. The full TBI protocol is included in Appendix 1. Some of the questions included: (1) How do you maximize student learning in your classroom? (2) How do you describe your role as a teacher? and (3) How do you know when your students understand?

Stimulated Interview. Teachers were asked to reflect on their growth, in terms of both practices and beliefs, at the end of their third year in the classroom. These reflections used classroom observation videos, one from each year selected by the researcher based on the video and audio quality, to stimulate reflection. The participating teachers were asked to watch three videos of their classroom teaching from their first year as a teacher through the third year in the classroom. They were asked to reflect on their past experiences, on their development, in terms of practices and beliefs after three years of teaching in the classroom were completed. After having sent the videos for the teachers to watch, the researcher scheduled an hour long interview. The teachers reflected extensively on their development as a teacher. They watched them prior to the interview and were asked to describe how their thinking about science teaching and teaching practices have changed over the last three years. The full interview protocol is in Appendix 2. These data provided opportunities for both micro and macro-analysis of the development of beliefs and practices over time, considering single salient events and longitudinal analysis over time.

In the fourth year of their teaching career, a final interview was conducted in a way to wrap up the PREPSci project that the teachers were involved in. The questions included: (1) Describe how your thinking about science teaching has changed over the

past three years? (2) Describe how your teaching practices have changed over the past three years? and (3) In what ways do you think you have improved in your teaching over the past three years?

Reflective Journals: Teachers were asked to reflect on their teaching throughout the induction program through the use of reflective journals. The reflective journal is a “free write” space where teachers are merely asked to reflect on their practice in ways that are meaningful to them. Anwar et al. (in preparation) found this data source to be particularly valuable when exploring teacher reflective practice, providing highly descriptive and contextualized insight into the thinking of the teacher. These data are in the form of digital documents authored by the teachers.

Data Analysis

All interviews were analyzed and coded using an inductive approach where they were openly coded (Patton, 2015) to identify the initial codes using the software Dedoose™ (dedoose.com). Major categories emerging from the data were then captured to make a coding schema. Initial analysis yielded a list of 40 codes that reflected recurring themes. Emerging codes were discussed with two other researchers who helped with the initial coding and revised within the context of the data set. As the final set of 49 codes were created, they were imported and listed on a google document. The codes were then grouped based on the themes that emerged from organizing and reorganizing the set of codes. Next, emerging themes were combined and categorized into larger themes (Aronson, 1994). The results were then cross-validated by two other researchers who worked on the project. Finalized themes represented a consistent pattern in responses across the three participating teachers. Of the most prevalent themes, participant

responses which addressed the research questions were further analyzed and included in the findings section. The three major themes that emerged from grouping the codes (see Table 3.3) based on the responses of the teachers which addressed the research questions were: role as a teacher, instructional practices, and enhancing student learning. The reflective journal responses and field notes were color coded with comments based on the three themes to support answering the research questions. The classroom observation videos were watched with a focus on identifying the themes that emerged from the interviews to support answering the research questions and were made note of as researcher memos. These recursive steps offered a substantive triangulation of the data (Miles & Huberman, 1994).

Table 3.3 *Themes and codes*

Themes	Codes
Instructional practices	Finding a balance between inquiry and direct instruction Individualized learning Inquiry based teaching Inquiry teaching takes time to develop Hands on learning Learning should be relevant to students' lives Making excuses for not doing inquiry Scaffolding Student discourse to guide learning Utilizing technology Ways for getting all students' responses - sampling understanding of a topic When Inquiry isn't working, resort back to traditional practice
Role as a teacher	"I'm a facilitator" Building students' self-concept and science identity Classroom managements - One on ones with students Guide Managing learning Messaging Growth Mindset Providing support Supporting Literacy
Enhancing student learning	Classroom discussion Creating systems/routines male vs female real world application Self-evaluation Student learning & understanding- a priority Student discourse to guide learning Students engaged in the lesson Teaching & learning Teach the skills When they can teach it to others

CHAPTER 4: FINDINGS

This dissertation was guided by the following research questions:

- 1) How do beginning secondary science teachers' professional identities develop over their first three years in the classroom?
 - a) How does their reflection on their beliefs and practices mediate that transition?

In this chapter, all three cases are presented in their entirety, with cross case analysis between the teachers presented in Chapter 5. Each of the three individual cases are presented with an aim to answer the above research questions. The individual cases are presented by focusing on the teachers' developing identity as beginning teachers in terms of their roles in the classroom, their teaching practice, and ways to enhance student learning. The following section summarizes the findings of the qualitative data acquired via interviews, observations, reflective journals, and from the teachers' reflection on watching the videos of their classroom teaching (stimulated interview).

The Case of Alex: The First Three Years

Alex chose teaching as his second-career. In his words, he has tried out a few different paths, from a professional water-skiing career to a brief stint in medical school. He worked as a chemist for 7 years after which he decided to meld "his love of science" with his passion for working with youth. After completing his licensure program, Alex became a 9th grade Physical Science teacher at Noether High School. In addition to teaching physical science, Alex was also an assistant football coach and in his third year of teaching at the school he became the science department lead.

Noerther High School is a college-preparatory school which aims to provide exceptional instruction and small class sizes within two different academies: The Noerther Academy of Arts and Communications which engages students as they study humanities and the sciences through the vehicle of arts and the Noerther Academy of Science, Technology, Engineering and Mathematics which aims to provide creative, hands-on methods engaging students in learning. Noether is a high-need, urban school with a 91% of African-American student population. Only 4.8% of students were proficient in reading, 11.4% of students were proficient in science, and 8% of students were proficient in mathematics in 2018 (Minnesota Report Card, 2018). The school is located in a neighborhood with a median household income of \$27,000, with 44.1% of households having school-aged children under 18 years of age. 87% of the students are from low income families and the test scores fall far below the state average for all students. 19.4% of the people in this community hold a bachelor's degree or higher, with 74% having a high school diploma or higher. This community is 86% people of color, with 14% of the community being white. 65% of the families in this community speak English only in their households.

Alex's teaching philosophy from one of his reflective journals at the beginning of his teaching career was: "To treat the brain like a muscle - challenge it and make it strain a bit in order for it to grow stronger." He explained that he does this by exposing his students to natural phenomena through hands-on, interactive activities and then helping them develop explanations for the observed phenomena. He stated:

In this way, I am not just telling them scientific facts, but developing their scientific skills, knowledge, and literacy in the hope of assisting them in reaching

their full potential of becoming life-long learners, problem solvers, and educated community citizens.

In the process of identifying himself as a beginning teacher, there were three major themes that were predominant mainly in the interviews. I noticed that Alex had a lot to say on his developing role as teacher, his teaching practice and student teacher interaction with regard to student learning which are presented below.

Alex's Developing Identity as a Teacher

Role as a teacher. At the beginning of his first year as a new teacher, Alex was not completely comfortable in his role as a teacher and held conflicting identities. He wanted to be a *facilitator* in the classroom, but in an interview early in his first year as a teacher, he shared two conflicting identities related to his role as a teacher:

I think of myself as a facilitator to guide them in their learning. That being said, I am more of an authoritative source in the classroom, I think...

Alex acknowledged that the events in his classroom regarding classroom management caused him to turn to a more traditional role where his teaching was more lecture oriented. He considered his role as becoming more traditional, and also stated that he wanted this role to change over time as he figured out what works best for his students.

For example, he mentioned:

I'm hoping to introduce and ease them into these activities, and step back as that authoritative person in the classroom, and get them to recognize that they're responsible for their learning, and give them the skills to satisfy their curiosity.

Indeed, in the fall of his first year, Alex was observed in his desired identity of facilitator. His role as a facilitator was evident from his mid-year teaching observation where his

students worked on a guided inquiry lab on Newton's first and second laws and applied them to real-world application where Alex modelled the lab activity and facilitated the discussion.

Alex also added that he had been trying to prevent himself from too much explaining as his students seemed to not follow him. He stated:

Honestly, I try to prevent myself from explaining too much, so it's that facilitator role that we talked about, which is kind of fun. Then if the students ask a certain question, you can kind of reword so that they're using the vocabulary that you want them to use. So, you can kind of guide it in the right direction.

However, towards the end of the first year in May, his identity had shifted from "*facilitator*" to "*manager*." In his words:

Before I would say a facilitator, but now it's more of a manager. This isn't what I want it to be, but it is. It's managing to keep the kids on task, whether it's with notes or with an activity. I guess I could say that I am there for support, as well. They do work well in the small groups, so in that aspect I'm more of the facilitator for their learning.

Alex clarified the meaning of terms facilitator and manager stating:

A facilitator would be someone who kind of lets them do their thing and helps out if they have a question and introduces some brief instructions on how to do an activity and then let them explore and answer anything that they have struggled long enough with. Whereas a manager is more of walks side-by-side with you as you do this and maybe you struggle less and be less frustrated along the way, but more willing to do the work.

During the beginning of his second year of teaching, Alex continued to identify his desired role as a facilitator. He went on to describe his role as a “facilitator”, stating:

Ideally, we get them curious and engaged and they start digging on their own, and I’m just there to assist them and help them where they need it. I see my role as setting up the challenge or the struggle that makes them work to learn something, and then I’m there to help them get through that struggle. If they have any questions... questions that might be beyond what they’re looking at or techniques and strategies to get them there, that’s my job. It’s not necessary to give them the content, that’s their job.

Towards the end of his second year, he did see himself moving away from being a facilitator to again being more of an authoritative person in the classroom with regard to behavioral management as he stated:

I still think of myself as a facilitator of learning, however, as a 9th grade teacher at Noether, it’s very much a guided facilitator, quite often and more often than I would like. It’s kind of being the authoritarian but not so much for the learning aspect as it is for the behavior issues.

Alex also expressed his desire to be more involved in students’ learning than he was at that moment as he was struggling with classroom management issues, which were taking too much time away from being there to help his students learn. When intervened as to how he wished his role to look like if he did not have to deal with management issues in his classroom, he stated that his goal would be to get the students actively engaged in critical thinking. This showed his desire to develop critical thinking skills in his students. He continued,

Ideally, probing student ideas and getting them to connect their ideas with the science content is the ultimate goal. It's really getting them to think deeper than that superficial level of "I got the right answer" and more to maybe there's not a right answer, but there's a way to think about this if there's a way to approach it.

In his third year when reflecting on his development as a teacher, Alex described that his interactions with his students had been satisfying and acknowledged that he has been fluctuating in his role as a teacher from being authoritative to being a guide while interacting with his students.

I fluctuate between ... Like I try not to be an authoritative figure in the classroom because these kids ... many have authority issues. I think they get enough of that to be honest. But I also don't want to be their friend. I'm here to be a guiding force. So, it's a delicate balance and I mean sometimes I'm more on one side than the other. But I think I do pretty good at it. The kids respect me but not necessarily each other or the class all the time. But I do think the evidence for that is kids have told me that they do ...

Overall, in the first three years of his classroom teaching experience, I noticed that Alex's identity with regard to his role as a teacher had been fluctuating: going back and forth between being a facilitator, manager and a guided facilitator. Eventually at the end of his third year, Alex seemed settled with his identity as being a guided facilitator. In the final interview conducted at the end of his fourth year, Alex acknowledged that his role as a teacher has changed and continued that he has improved in providing clear directions to his students without much scaffolding. When reflecting on his development, Alex had to say this:

I don't ever sit back and reflect. I probably should. I like to think that my lesson plans have gotten better. I'm trying to make the kids not necessarily do the work but do the thinking, and make their thinking more apparent. I think I'm slowly but surely getting better at that. I'm very much learning what misconceptions the kids come in with. Just as a general population of this school, what they're familiar with, what they're not. And that's been very helpful.

Teaching practice: Balancing inquiry and lecture. During his first year of teacher, Alex mentioned that he was still working on his instructional practice to maximize students' learning. He stated that inquiry based activities were not working in his classroom for his perception on his students was that, it was getting tough for him with classroom management while engaging the students in inquiry activities. At the start of his first year as a teacher, Alex stated:

The inquiry events I try to do really frustrate the kids, so I've taken a step back and now I'm trying to build them up so that they can conquer inquiry strategies much more efficiently. So, I'm adding a lot more scaffolding, I guess.

It was evident that Alex had been trying to do inquiry based activities to promote student learning and engagement. For instance, from one of the classroom observations early in his first year, I noticed that Alex tried to engage his students in inquiry activity. The activity was called "Operation Cell phone rescue lab". The students were referred to as scientists in the scenario which was based on a real-life context - students at a Fetty Wap concert who lose their cell phone after taking a selfie with Fetty. The lesson was on Newton's first and second laws. For this activity, students were asked to use their shoes to determine which surface had more/less friction force. The students worked with a

partner where they each used one of their shoes to place on different surfaces (to simulate different terrains) and use the mass set (to simulate the friend being lowered). They had to test different scenarios to see what was the maximum mass that can be held for each set of conditions and masses.

Alex also added:

When some of my inquiry stuff and activities may not be working, I tend to fall into that lecture-notes-kind-of-strategy, which isn't the greatest. That's about 30-40% of my class time right now.

As Alex entered his second year of teaching, he recalled that as a first year teacher he was stressed about keeping his students engaged in the classroom that enabled them to better understand and relate to the concepts that were being taught. He insisted that as he entered this second year, he was going to strive on creating the excitement in the students which to him drives student learning. This is evident from the following interviewed response:

I think last year I stressed just getting them engaged, because a lot of this physical science is stuff that they've seen before and just putting it into a context that they can understand and relate to. For me, it's all about getting them excited about what they're doing and getting them curious about the stuff, and I think that drives the student learning, instead of me just forcing it down their throats.

After having re-assessed himself for over a couple of months in the summer, Alex strongly believed in making the context relevant to his students' lives. He was of the opinion that he wanted his kids to get excited about science and develop the lab skills in

addition to getting some of the basic concepts when they went into Physics and Chemistry.

Alex mentioned that although he tried inquiry activities, learning was not taking place in his classroom and that students did not seem to be engaged unlike structured learning style which has helped in student engagement and motivation in his classroom.

I've tried some more inquiry-based activities. I was trying them, but they were kind of quick ones. I don't think there is a lot of learning going on, well there is, but it's not focused and it's not instruction, but it's a great way to engage the kids. Since they've played around with it and they explored it, they've come up with some questions on their own. Going from there to a more structured learning style has seemed to help immensely as far as engagement and student motivation.

Alex also added:

The kids are very good at taking notes, reading the notes, studying the notes like right before a quiz, and then taking the quiz and doing well on it. If I give them the same exact quiz a week or two later, there's no retention. I still use that method because the kids are good at it.

When further questioned to have a better understanding of how he implemented inquiry activities to encourage student engagement, Alex acknowledged that part of it was his fault and added that the students weren't learning from it as he missed opportunities to promote learning. He stated:

I didn't ask the right questions. For one of the activities we did, I had the kids build a roller coaster out of foam tubing and we were looking at kinetic and potential energy changes. The kids could see that they could only have a loop that

was a certain size or a certain shape, but they didn't really get to the point where they knew why that is, but it got them curious about it and got them thinking about it. Then from there you can bring it into the classroom and work from there up. Well there was explaining the procedure, but other than that, honestly, I try to prevent myself from explaining too much...

It is evident from Alex's statements above early in his career, that while his students weren't learning much from inquiry activities, he found it difficult to create opportunities to promote learning and that classroom management was problematic. Towards the end of his second year, he mentioned that every once in a while, he asked for students views on his classroom instruction through an exit ticket and that students expressed their desire to be involved in more hands-on activities. It seemed that while his students preferred hands-on activities, he had a hard time connecting such activities to some concrete learning which is understood from his following statement:

Every once in a while, for an exit ticket I ask them what they think about the class or what they think about the last unit, and quite often they think it's boring and don't like the content. They want to do more labs and hands-on stuff, which I actually agree with, but I struggle connecting hands-on activities to concrete learning, and a lot of time I've backed off some of my activities due to safety issues. We do a lot of whiteboard stuff and the kids are throwing around markers, then I'm not going to trust them with flames just yet. I think part of it is just me not letting off the leash or fear of that, but yeah, a lot of the kids say it's boring and hard.

I understood from his statements that although inquiry is something that both his students and he as a teacher would prefer, classroom management is a factor that acts as a hindrance in implementing inquiry successfully. He had conflicting identities where he expressed his views of engaging the kids in learning by providing them access to inquiry based activities, but at the same time felt the need to stick to traditional teaching style. This is supported by what he had to say:

When it's traditional school teaching, like reading out of a textbook and taking notes... we can go much faster with much less behavior issues if we take notes or just do textbook readings. The kids are used to it and they're well trained for the most part, but you can tell that the interest and the engagement is just dead there. So again, it's a balance... I want to move along, but at the same time I want to do activities. I think that it's safe to say that engagement, at least with my kids, can be equated to learning.

Towards the end of his second year, Alex expressed his desire to continue inquiry while keeping the students engaged and helping them develop critical thinking skills. He stated:

I want them to have the skills of investigation and questioning of continuing investigation and these kind of critical thinking skills. That's the kind of approach I take... and this year I'm trying to go a little more in depth than a superficial broad cover, again to try to get them to understand the concept rather than be able to answer the multiple choice question correctly.

In his third year while reflecting on his teaching practices, he took a stand on having improved specifically in his teaching. He stated that his teaching practice has

changed in some ways over the last three years. Now being in his third year, he seemed to be into guided-inquiry which he explained:

There's some stuff, I think my first year I didn't ... I feel like I did much more open-ended inquiry activities. I want to get back to that a little bit but I want to get back to that in a purposefully guided way. So, I stepped back from straight inquiry because I was finding the kids were distracted. They weren't focused, it was hard to get them to stay focused. Then I think I went too far the other way where I ... It's a little bit too guided and too hand-held. So now I'm trying to find that balance of scaffolded enough that they have the support yet making them actually think and come up with the answers on their own instead of just repeating something.

While Alex added that he hasn't improved as much as he wanted to citing time constraints as a major hindrance, he felt the need to help the students focus and expressed the desire to get them back into more inquiry based activities. As he reflected back on his development at the end of the third year, it is clear that there has been significant development from what he reflects based on his experiences during his beginning years. He also acknowledged that he has been attempting to get the students involved in activities that are more project-based which is evident from his statement:

I'm attempting to get a little more project based. And just for my own sanity I'm trying to do one project a quarter. I'm not successful at that, but I'm getting better. And each one, each year, the lessons improve.

Enhancing student learning. In his first year of teaching Alex professed that he had been adding a lot of scaffolding in his interaction to promote student learning as his

questioning technique did not work well with his students. Alex had the following to say about his questioning technique:

I kind of started the quarter of the year opening up with some fairly deep questions that might not have an answer, and the kids may or may not have the prior background, but I was trying to get them to use their logic and reasoning to get there, and that did not go over very well. So now it's more of level 1 questions and then working our way up to the level 2, level 3 questions and stuff.

While he expressed that he wanted to focus on scaffolding and challenged himself to do better to get his students more engaged in the classroom, he stated that he has been “adding a lot more scaffolding”. His initial belief about scaffolding was to provide students with the tools for them so that they can figure out on their own. In his writing journal during his first year as a teacher, he had the following to say:

I'm beginning to realize (and that I should have probably realized a long time ago) that I have to adjust how I think about scaffolding. Initially, I thought that if I provided students with helpful tools and provided them with sentence starters and equations and lists of procedures, this was enough for them to figure things out on their own. I've come to understand that giving the students the tools does not mean they will know how to use them. ...I guess I never thought of myself as a scaffolding tool to be used. I saw myself as being too authoritative in how to do things and activities not being student-centered enough. But the kids, initially, need this. Especially freshman. We'll see if I can begin this new scaffolding technique, slowly weaning myself out, and get the students directing themselves to some extent.

Alex acknowledged that he felt the need to work on his questioning technique and add more scaffolding to it which is understood from what he had to say in the following statement:

I'm discovering that in all my labs, the questions I ask are not the ones I should be asking, but I do think that project was good. May be not ask so many questions, but I would scaffold...

He went on to give an example of what did not work while questioning stating:

... I had them write a conclusion and this was the first time they wrote a conclusion, and at the beginning I had them read a hypothesis so they were pretty good at that. Then at the end they had to write a conclusion stating whether your hypothesis was supported or wasn't supported and show evidence as to why that is, and they were not good at that. But beyond telling them in three sentences what a concluding paragraph is, I didn't give them an example, so I want to kind of ease them into that. That ended being a very invalid assessment because the kids couldn't struggle through that or they just didn't do it because they didn't know what I was talking about.

Towards the end of his first year, Alex continued to emphasize the need for scaffolding.

I do think I need to focus... and that's kind of what I started doing third quarter, is scaffolding better for my kids so that it's difficult but still do-able. That's a balance that I'm figuring out and my kids are kind of along for the ride.

He also added:

This second semester, I kind of back-tracked from inquiry activities and I do very heavily scaffold-guided activities now due to the classroom behavior and keeping them on task and focused.

Alex in the process of enhancing student learning, improved his scaffolding towards the end of his second year as a teacher. This was informed in his own words at the end of his second year:

I'm building the scaffolding better than I was before, and that definitely helps keep the kids from shutting down early, which definitely helps student learning. I don't know if this for sure helps student learning, this is just textbook teaching, but I've been hitting it from different modalities. A lot of times I'll introduce a unit by reading it and seeing the vocabulary and seeing it in context, then we'll have a discussion and a short lecture, and then we take notes.

As Alex reflected on his development in his third year, he had the following to say:

The main thing that's changed really is the approach which I've taken. I guess mainly in how I scaffold the lessons. So, learning what scaffolding works, which scaffolding doesn't work, really pinpointing what I want them to show me. Asking the right questions to elicit the thoughts I want them to give me. Focusing on the correct questions to ask, giving them the support that they need. If they're struggling with words giving them the words that they're struggling with....Time constraints have been difficult to deal with, so this year has been kind of a repeat year for me a little bit.

It is to be noticed that by the end the third year Alex began to understand the students in relation to the school context that he was teaching in and adapted to it by changing his

approach to meet the needs of his students in the classroom. Alex continued that his questioning has improved as repeating lessons have been much effective and easier which is evident from his statement below:

I've been very specific about questioning. So, assessment questions are ... I analyzed quite a bit to make sure I'm listening. I talk, I want them in class... Some days are better than others. Repeating lessons is obviously much easier than doing the new ones.

For instance, in one of the observations in the fall of his third year as a teacher, while teaching a lesson regarding the calculation of time and distance, I observed how he framed the questions for better student understanding and went back and forth to what has been previously taught to students in their earlier classes. Students had a hard time figuring out the unit of measurement for time and distance. After repeated explanation and questioning, students still kept saying said that time was measured in m/sec. He then went on to question them asking, "If I say the class period is 53 meters/second long does it make sense?" Students said that it was still confusing for them. Although he seemed to be frustrated, Alex never gave up in helping students understand the concept. He continued explaining by giving examples that were relevant to them and constantly questioning to help them think until they got the units of measurement for time and distance right.

Alex also added that he wished he could still improve and that past experiences have helped him gain a better understanding of what works for him in his classroom.

I'm not as prepared as I want to be, I am much better at focusing my questioning because I've taught this before. Like I said I would prefer to anticipate questions,

misconceptions, stuff like that beforehand. But in the cases that I don't, I'm better at improvising and being flexible with my classes.

At the end of the third year, Alex acknowledged that his thinking about science teaching and teaching practices has changed over the last three years, specifically with the approach he has taken. Alex saw himself as having improved in scaffolding and that his first year of teaching was more well planned. As he continued to reflect on his experiences as a new teacher, he kept insisting that he got much better at scaffolding and questioning techniques. He also acknowledged that teaching the lessons repeatedly over the last few years provided him the experience that enabled him to improvise each and every time in the best possible way. He again referred to the earlier experience of having taught the lessons in the first and second year, that contributed to his improvement. However, he acknowledged that his main goal remained the same being instilling critical thinking in his students. He continued stating:

My first year I was not flexible enough ... I got caught off guard on that. Whereas this year if I get caught off guard, I have the tools to bring the class back. I mean just experience on the job training kind of stuff has been extremely helpful with classroom management. From that aspect I am much, much better than I was in my first year.

Alex acknowledged that time was a constant challenge that permeated his personal and professional life. When comparing his first year through his three years of teaching at Noether, Alex expressed that in his first year, he had been analyzing quite a few of his lessons while in his 2nd year he had been analyzing almost every lesson whereas in his 3rd year, he hasn't done it due to time constraints with three preps. Alex continued that as

he had been gaining teaching experience over the first three years and felt that he has grown a lot in terms of teaching and interacting with students.

So, I had a lot of experience already just from previous jobs and coaching. So, I had experience with kids, not necessarily inner city and American, but I might get yelled at for saying this. But on some level kids are kids and they have the same needs. They need to be loved, they need to be included, they need ... All these things that are broader than race and socio-economic class. When I first graduated, I don't know. But I feel like I would have given a book answer to some of these. Like, "What's a good lesson?" So that's definitely changed. And I do think, and I kind of hope as well, teaching, it will continue to change. As frustrating and as stressful as it can be I kind of like always reflecting and always trying to improve and always trying to figure out what's best.

At the end of the fourth year, when he was asked what his beliefs were towards teaching as a beginning classroom teacher and how has it changed over the last few years, Alex mentioned that he came in with an attitude ready to face the challenges head on. He added that over the last few years, he has grown from being more self-centered to being more student centered enabling them to develop life skills through scientific lens.

Uh, coming in here I was looking for a challenge and I got that, and I wasn't looking to save kids or anything, but I did think that I would get kids excited about science and maybe push a few towards the sciences as a career or as a, you know, a possibility at least. Um, now, and again, this is the argument I had with myself. Did I, did I lower my expectations or did I just make them more realistic? Um, but now I try to develop life skills for these kids, through a scientific lens.

So, I mean, because science is just a way of looking at the world and it's a way of solving problems. So, if, if I can get them to start thinking more critically, and I, I use this term very vaguely, but scientific solutions to different problems.

While the majority of the students at his school were African American students, he being a white male teacher, did not explicitly talk about race in the interviews related to his identity development. Yet, while talking about the students in his classroom, Alex often referred to his students as “these kids”. For example, in one of the interviews in his first year, he stated that, “These kids aren’t going to benefit from bombing all four quarters of science their first year of high school.” This suggests a deficit lens of Alex towards his students who are not identical to him in terms of race and social class. However, race was not an explicit part of Alex’s identity development.

School context played a major role in influencing his beliefs towards his students, thereby providing him opportunities to make the choices he made in terms of his instructional practices and approaches to enhance his students learning. As Alex gained experience working with his students by employing various approaches in enhancing their learning, he moved away from the deficit lens and gained insight about the individual learners in his classroom, seeing them as having potential as learners. In teaching, teacher’s belief in every students’ ability to be successful in learning, to participate, to co-operate, to believe in oneself to reach success irrespective of their race is an important factor (Ročāne, 2015). Alex by the end of his third year started to believe in his students as learners, and had a positive outlook towards them.

The Case of Sue: The First Three Years

Sue is in her fourth year as a teacher. In her first year, she worked at Oxford Learning Center, an urban middle school where she completed her student teaching. It was a one-year position to replace her cooperating teacher who was on leave. Oxford Learning Center is a member of the national network of Expeditionary Learning (EL) Schools, which promotes rigorous and engaging curriculum; active, inquiry-based pedagogy; and a school culture that demands and teaches compassion and good citizenship. The school's website mentions that the curriculum is designed around Learning Expeditions – projects that allow students to investigate issues in their school, the community and the world. The school's philosophy is to create a child-centered school and it was the original magnet school in the district. The school program is based on hands-on methods that encourage curiosity as well as discovery and self-directed learning guided by interests and abilities. The school demographics includes 17% Hispanic or Latino students, 1% American Indian or Alaska native students, 12% Asian students, 9% African-American students, 55% White students and 5 % two or more races and 34.4% of students receive a free or reduced price lunch (Minnesota Report Card, School teaching 6th grade physical science and 7th grade life science. In addition, she was also one of the Theater Advisors at Morgan. Morgan is a high need urban school with 35% African American students, 17% Asian students, 9% Hispanic or Latino students, 37% White students and 2% American Indian students (Minnesota Report Card, 2018), of which 58.5% have access to free and reduced lunch. Test scores at this school fall below the state average. The school purports to build character for every student through their core values and active parent and community partners. The school's website

also mentions that they make science fun by producing the largest one-day science fair in Minnesota. Accelerated classes offer high school credit in science, geometry, Spanish and French. Morgan's extended day program allows students to explore interests and build skills in academics, arts, athletics, and technology. While Sue taught 7th and 8th grade Science during her first two years at Morgan, she switched to teaching 6th grade Science during her third year due to lack of support and co-operation in terms of planning from the other 7th grade Science teacher.

Sue's Developing Identity as a Teacher

Role as a teacher. In the beginning of her first year, Sue was overwhelmed with her role as a teacher as she saw herself playing multiple roles in the classroom. She mentioned that the roles included: teaching the students to read and take notes, prepare them for summative assessment and help them to be 'good questioners'. She stated:

I think that I have lots of roles, but as far as learning roles go, I need to teach them the skills to be able to learn, so that includes like note-taking and how to read articles and how to take things out the video clips that we watch. I need to present the material multiple times and in multiple ways, which is nice because our learning targets are broken down into supporting targets, so if I hit the supporting targets at least two times, that helps support the bigger learning target, which is based off the state standard. ... also think it's important for me to teach them to be good questioners, and they really hate it when I do this.

During classroom observations in her first year, the students struggled to stay focused and pay attention. The students were running around, chasing each other, taking over the class despite several instructions given by Sue. She spent the entire class period

dealing with behavior issues.

In the middle of her first year teaching, Sue saw herself as a facilitator, providing resources and helping students engage and explore. She added that even though she saw herself as a “facilitator” she still occasionally used “direct instruction.”

My role is to facilitate the learning, in that I’m providing the resources and the means for them to do that, like I come up with the engage things and then I let them explore, I give them some way to do that. Sometimes I do direct instruction and sometimes I have those videos where it’s kind of like we’re co-teaching, not really because it’s a video, but it will say something and I’ll pause it and rephrase it in a different way or maybe add something to the diagram that’s on the video.

While Sue seemed to be getting comfortable in her role as a teacher, she developed conflicting identities with regard to the role as a teacher. At the end of her first year, she expressed multiple identity roles: *facilitator, stage manager, coach, and mentor*:

I would say that I’m a facilitator. I provide them with the resources and the materials and instructions, sometimes, to learn and to be able to learn. I do all the behind the scenes work to make sure they have all these varying levels of support and making sure that they are safe and respected. I do all that and then I just let them put on the show. I think it’s a facilitator or stage manager...I guess I’m also like a coach. I think mentor is another word because some students confide in me and we have talks about things going on at home or things happening with their friends.

As Sue entered her second year of teaching, she reasserted her role as a facilitator, providing the tools and resources to her students while creating a safe environment to

help them learn.

I like to think of myself as a facilitator for learning, I think I've said that before. I will provide them with the skills and the tools and the resources and a safe, respectful environment to allow them to learn. The kids are the ones doing the learning, and I can't force them to learn. I think that's how it is.

However, in the midst of the second year of teaching, she was frustrated in not being able to fully execute her desired role as a teacher, while she identified herself as a facilitator, she continued to struggle with behavior problems which was one of the major components of student disengagement in her classroom.

There's a lot more behavior problems, and I feel like I'm doing a lot more behavior management than teaching on some days, and I know some other staff have said that, too. It's been kind of a roller coaster. I would say I'm like a facilitator because I help give them the tools they need and the skills they need, and that would also include the behavior component, like I would be moderating their behavior. In my advanced class, they're much more capable and they're at that level ready for me to give them the things they need and then go, whereas the life science kids need a lot more support. I'm still facilitating and not just throwing information at them in hopes that it gets into their brain, but there's a lot more hand-holding with that class because of their reading and math levels, how they behave in other classes, and I have them at the end of the day. So, I would say that I hope to give them skills and things so they can get the knowledge themselves, and give them activities and lessons and things to do to take it in and learn.

At the end of her second year as a classroom teacher, Sue still strongly asserted her role as a facilitator. She added that she wanted to be able to give the students voice stating:

I'm the organizer or facilitator of all that. As a teacher, I have to think about all those things I talked about and personalities in the class and my observations on how they learn and make sure that my grouping is good. And also to ensure they're arranged in a way that they can see and learn and that I give a chance for students to voice and that I listen to that and planning all those activities, like making sure that we don't just have notes all day long, and making sure that I'm catering to their needs so they can be comfortable and they can learn effectively.

In her third year, while reflecting on her teaching practices and development, Sue affirmed her role as a *facilitator*. She referred to the time when she was observed by her administrator in her third year, who indicated about her shift in the role which was obvious to him from the earlier observations. She continued saying that the administrator indicated her role has become less *authoritative* in helping the students learn rather than trying to *control* the students. Being a third year teacher, she continued to work on classroom management, by constantly reminding students of the routine that needed to be followed and encouraged them to engage in small group discussions rather than whole class discussion.

I just had my third official observation, with my administrator. And he was saying how it seems like from last year to this year, it switched from an authoritarian classroom to like a more community vibe or... I can't remember what he told exactly... But what he mentioned was that it felt like I was trying less to get control of my classes and more like I was just truly being an educator, like an

excellent educator. And I was thinking, reflecting like, "Oh, yeah, I do feel like this year I'm not grasping for control as much," that I settled in and I worked really hard on my routines, especially the coming in routine, so now they're circling, because they were not following that routine. They were kind of writing, and it would be a fight to get them to write, and a lot of them have trouble writing anyway. And so, we started doing sharing in circles next year...Last year, I was like, "I am the teacher. Here you can listen to me," and having me care about the kids, but not getting that back, like not having the kids be truly excited to be there. But I'm feeling overall now that they're happy to be in the community. They're not frustrated about the things that go on and that I'm finding what I'm putting out is coming back.

While classroom management was something that she has been working on and succeeding, she felt the need to also work on closures which to her was on her checklist for her development. She continued stating:

I want to work on my closure. Which has been my power goal this year, and it's not done. That's okay, because it's in progress. I have to remind myself. Yes, still working on figuring out a routine for closure, or different strategies that I can use that I can teach the kids, so that they know it, and then we can just pull out whenever we need them. Maybe have it related to a student job. I tried a little bit of it this year, and they seemed to like it, but it was not how I want it. Closure I think is gonna be my big focus next year.

She added that she had always seen herself as a facilitator, being able to give the students authority in her classroom thereby enhancing student engagement. She stated:

I've always said that I feel like a facilitator. I've seen that go from an idea to more of a reality. I don't know if I'm there yet, I don't know if I'll ever be totally there. I think it would be nice if I can just ... Giving the kids power, and letting them have jobs is one thing that I implemented this year. I can see how it changes the community, and it changes the kid's engagement. They respond to their peers, as leaders. The kids get to practice being leaders.

Teaching practice: Balancing inquiry and lecture. At the beginning of her first year as a teacher, Sue mentioned that although her students like doing hands-on activities, they have a hard time connecting to the understanding and purpose of those activities. She found it difficult in helping them prepare to understand the purpose of the activities. She stated:

They really like labs, but why it's hard for me is because they don't like to do a lot of the reading and prep, and so they just want to go full on into the lab when they don't understand the procedure because they didn't read it fully or they weren't paying attention when I did the demonstration. That's going to have to be one of my goals this year. And I want them to understand the labs, we're not just doing it so you can pour chemicals and have fun. To have them be more responsible for the reading that needs to come before labs, and after, too. So, if we do it as an inquiry one where they get to play around for the first part to make them want to explain it, is going to be something that I need to work on for them. They like doing it and talking about it a little bit at the end, but then they're back to content and they don't find it very exciting. So, I need to find a way to bridge what they did to what they say and why it's related to what we're doing, and

make that more interesting.

It is evident that Sue wanted her students to be involved in hands-on activities and also to be actively thinking, questioning and reasoning about those activities. Towards the end of her first year of teaching, Sue agreed that she implemented direct instruction as it helped her to manage her classroom in terms of behavior unlike in labs, where the students seemed to be distracted too much as they were not ready to follow the instructions.

Sometimes I do the direct instruction for explain, and sometimes I have those videos where it's kind of like we're co-teaching, not really because it's a video, but it will say something and I'll pause it and rephrase it in a different way or maybe add something to the diagram that's on the video. They really like labs, but that's hard because they don't always follow instructions because they want to wander around. I have to balance keeping them busy with safety. If I give the 7th graders discussions, they talk for about a minute and then they're on to just chatting about like Instagram. With the 7th graders it's a lot more direct instruction.

As Sue entered her second year of teaching, she continued to struggle to engage her students in inquiry activities. She professed that while engaging the students in project based activities consumed more time, it provided her the opportunity to get to know her students better. From her perspective, she added that she could envision her students enjoying doing inquiry activities although they haven't experienced inquiry in its fullest sense. She went on to say:

The projects that we've been doing have been taking a really long time and the

kids are very slow... I don't know why; I think it's because they're really social. I'm still getting to know these kids, but they really like hands-on activities, and even if it's just something where they have to put the equation in order using cars or something like that. They also like labs, whether or not the labs are inquiry, that is up for debate currently. I think they like labs, but I don't think they've experienced the full inquiry yet, but I do think they would like that.

During her third year as a teacher, Sue still maintained that while her students seemed to enjoy doing hands-on activities, she found it hard to keep them focused. She continued to say that while she still hoped to engage them in hands-on activities, her focus was to set up routines in the classroom to create organization and avoid disruption. She stated:

Having hands-on activities, especially with these kids, which is hard sometimes but I think with setting up certain routines at the beginning... like next year I'm really going to practice my transitions and expectations in lab versus in their seats right at the beginning because it will help make sure that they can go to the lab and be more successful at the lab. They really like doing the kinesthetic learning, and they get that social piece, too, because they can chat while they're working or if they get done early. They like being able to do that and have that time.

She added that her attention to routine and transition has helped her a lot and that she better understood what works well for her students. She added that her goal for the next academic year was to work on closure in addition to keep working on the routines. She stated,

I think that my attention to routine and transitions has really helped with that. So,

I think that's something that's changed, where I'm letting them have leadership roles and have jobs-like passing paper out when we need it ...So I think that has changed and then... I feel much more comfortable with the school's routine. That's because it's my second year here, that I understand them more fully, and I know how things work better. So that just makes me comfortable, like I know the supports that are in place and I know how to use them, versus, "I feel like I'm alone here, and nothing is helping," or I try to follow it and then I work for it. So, I'm just feeling more settled this year. And then closure is another thing that I go for. That's one of my goals for progress here which is working on closure. And so, it's baby steps with that. But I think that's one of the hardest things until I teach it more, like, timing. And it changes with the kids and yeah, so I'm trying to be more aware of it and work things in, to give the kids time to reflect on what they learned, and to be able to give me some feedback on what they know if they know it.

As she reflected on her development as a teacher in her third year by watching her own classroom teaching videos, she continued to stress the importance of routines in her classroom which has helped her tremendously in maintaining accountability for her students. She added that watching the videos of herself teaching has helped her identify the flaws and continue to work on things that went unnoticed in her beginning years. She stated:

It was kind of fun to watch what I was like and what my classes were like last year. I had forgotten some of the highs and lows. Just with the frenzy of having a new year and new kids. I could tell that the work that I had put in this year with

the routines and transitions really helped. Even in just comparing a typical day, versus that third video that we watched, because that was just a snippet of how this year's been going. Comparatively, all of this year versus all of last year, I could see that I'd improved in my routines and my expectations. I made some notes, I looked more comfortable. Things happened, kids interrupted and stuff, but I thought that my reactions were calmer, they were...and we can still have solid routines and kids can still be held accountable. They can know what they have to do.

Sue was constantly trying different techniques which helped her figure out what worked in her classroom. She stated:

I was just trying technique after technique. I was switching things up trying to find something that would stick. So, they did have a lot of change of routine. Maybe not so much expectations, but how they were followed through, or how they were expected to meet those expectations. I couldn't find anything that was sticking. The whole year was trying new stuff. I thought about how I wanted it to go. Then I worked backwards. What do I want them doing? How can I teach them the routines? How can we practice it? How can I reinforce it? ...Then we switched to circle. Now we circle, and they are pros and they do so well with that. It opened it up. It also gave me a way to check on with them, too. I feel much more confident in my teaching abilities, everything. It feels like it's all coming together.

She added:

I'm trying different things but... And I don't know if that's even a thing. This year I really wanted to focus on my routine, like I was saying. This summer I worked on

it, then right before school, I worked on it. I practiced coming in as a kid. Figured out where I should put the notebook bucket, then how I should set them up. I think I'm gonna keep how that's going. I haven't decided if I'm gonna do circle or not right away, or if I want it to be like let the kids feel that they're giving feedback. When they hit that point, at the end of the second quarter, when they're like, "I can't. I can't do this goal and POD thing anymore. I'm done." Then I can present it as, "Hey, let's take a vote, let's get some feedback from this class. Should we go to this different new mechanism?"

As Sue continued to reflect on her development as a teacher in her third year, she noted that her classroom routines have improved to a great extent.

Oh, I was looking at the notes routine and how that's strengthened. I could seem to know the expectations better. I've also incorporated student jobs this year. Like one kid is the clicker, and they get to click for the notes, and you see them come up automatically. I see that right away. Then just I was noticing my attempts at getting attention, and how they've changed in success. In the first one I was constantly reminding, in the second one I was still doing that but I was switching it up a little bit more, in the third one it seemed they were more responsive.

When questioned as to how she worked with her students in terms of behavior management, she stated that when the students were "assigned roles," it encouraged them to be responsible and become learners.

And I think that my attention to routine and transitions has really helped with that. So, I think that's something that's changed, where I'm letting them have leadership roles and have jobs, passes paper out when we need it...I feel much more

comfortable with the school's routine. That's because it's my second year here, that I understand them more fully, and I know how things work better. So that just makes me comfortable, like I know the supports that are in place and I know how to use them, versus, "I feel like I'm alone here, and nothing is helping," or I try to follow it and then I work for it. So, I'm just feeling more settled this year.

To Sue, getting the students follow her classroom routine was the most challenging issue that she had to face and being able to get that in place was a greater achievement. She continued to say:

In the first and second video kids are wandering everywhere. Then in the third video, they come in and they all get their stools and their desks, and go to their goal. They know what they're supposed to be doing. It looks like it changed a little bit in the first one, too. I don't even know where I was for some of it in the beginning. In the second one, and just like the ... I was bombarded with "I need this. I need this. Can you call this? I need a pass for this." Blah, blah, blah, blah. In the second one it was a little bit better, but there were still kids that were needy, and then in the third one, it seemed like they knew that we don't handle any of that unless it's an emergency. No one needed me to call anybody, no one needed a pass. No one needed me to tell this one kid to stop doing that.

While she noticed some changes in students' behavior when she was able to succeed in enabling the students to follow classroom routines, she also added that she garnered more attention from her students than at the beginning of her first year and gained respect from the students. She stated:

Over time I was noticing in the first one, I had fewer student's attention, and then

I gained more in the second, still not 100%, then in the third I gained even more. Again not 100%, I have work to do, but it seems like it could be all of those things working together. All of the routines and expectations and the follow-through, and just me being competent in the school and the curriculum, or more confident at least.

Enhancing student learning. In her first year as a teacher, Sue insisted on the importance of engaging students in group work to maximize student learning. She stated:

I try to create at times a safe, quiet learning environment. A lot of what we do is collaborative, so we go over group work, and I check in on groups. I think group work is one way I can easily maximize student learning because you learn better when you're teaching, so if students are in a group and someone doesn't understand, then instead of me coming over to ask it, I ask them what their group mates say, and then they can work it out together.

Her use of group activities could be seen from the field notes taken during one of the observations in her first year.

From this brief observation, I get the sense that Sue is a student-centered teacher. She uses formative assessments to make sure that students understand the task, she implements *cooperative learning* strategies on a seemingly regular basis, she is personable with them (refers to them by name), has high expectations of them ("you can get your notebook out and look at your notes" instead of telling the female student the answer), and she checks in with them throughout the lab. What I am less certain of is how she addresses issues like disengagement and keeps the class rolling when the majority appear ready to move on.

As she completed her first year of teaching, Sue was persistent in her goal of enhancing student learning in collaborative work. She added that the students understand when they explain it to their peers which helps identify their misconceptions when they communicate to others.

I know they understand when they can explain it to somebody else. That's like one of the flags that lets me know. Sometimes it can be the "ah-hah" moment, too, like when you're explaining or giving them this video and then they stop and go, "oh, I get it," and then they can say it back.

As she entered her second year of teaching, Sue maintained that involving students in group work where they were required to explain to each other about the concepts taught in class helped them in better learning and understanding. She added that when students explained and questioned each other, it helped them address their misconceptions.

I think they learned it best when they had interactive notes... I think involving the students in thinking about their own learning helps them actually do the learning. Since the kids are the ones doing the learning, they need to recognize that they are learning it. I think when I hear kids explaining it to other students, then I know they have a solid grasp of the concept, and when the kids are asking questions, I think they're in the process of learning because they're trying to address their misconceptions or lack of knowledge in certain areas.

While at the middle of the second year, Sue was convinced and maintained that when her students were assigned group work and engaged in discussions, it helped in enhancing their learning. She stated:

I think they also need to read it, hear it, watch it, and have them explain it to each

other, too. They like that peer collaborative stuff, like they really like “turn and talks”. I think it’s easiest to see when they help another person or explain it out loud to someone else or me. They can say that they get it and they can nod their heads or put their thumb up or whatever, but when I ask them if they could explain it to someone that doesn’t understand or can you tell me in your own words what it is... like the verbal formative check-ins or the written exit tickets.

During the end of her second year, she added:

They like to work in groups. They like the social component, like being able to talk out loud about science stuff. They like hands-on activities. They like labs, and I’ve called an activity a lab just to engage them more, because we’re not actually doing a lab but they like it to be called a lab instead of activity because it sounds more exciting.

At the end of the third year, while reflecting on her development as a teacher, Sue added that she could see how her students were engaged in being a part of the classroom in her third year, unlike her earlier years where she was trying to be more in control of them.

She stated:

In the third video, it seemed the kids were a part of the classroom. That I was in charge, but we also worked together because they have jobs. They have a say in, they affect how it goes. If they are having an off day, then we change the routine. I don't try to fight it as much. In the third video I know what to do and where to go, in the first and second videos I still knew ... but they didn't do it immediately. I think unclear expectations, ineffective consequences and the lack of feeling of community lead to this. I know last year that I was fighting them for control. I

didn't know how to stop doing that. It started off that way. Then it was really hard to come back from that. This year I feel way more confident and in control.

By the end of her third year in the classroom, Sue was able to try out teaching techniques and approaches in her classroom which eventually helped her gain confidence based on the impact of these approaches on the needs of her students and the school context that she was working in. She stated that watching the videos helped her see the positive and the negative things that mostly go unnoticed. She added that it helps her to get back to certain approaches that went well in her classroom, which she stated:

I think that's nice for me to see both positive and negative things. That's helpful, and then I can modify it right away, or for next year. It's just like another person, but then it's me just to make comments. I'm always trying to think in my head, reflecting on how things go and what I could change, so it's nice to have that bird's eye view of it, too..., and I can also remember things that I did really well that I want to bring back. That I might've forgotten about with everything that I was teaching, it just slips my mind. Or trying a different thing, but then noticing that hey, actually that worked really well. Like this closure thing. I did that last year, and I had no idea. I like to be able to look and see that for myself.

The Case of Anto: The First Three Years

Anto is a fourth year teacher at Kings Academy. The student body at Kings Academy is 62 % male and 38 % female. This school has 27.59% of students receiving free or reduced-price meals and 14 % students of color or American Indian or Alaska Native students and is considered to have neither a high nor low number of students of color or American Indian or Alaska Native students. The school demographics include

7% Hispanic or Latino students, 7% African-American students and 86% White students (Minnesota Report card, 2019).

Anto described Kings Academy as an Alternative Learning Center (ALC) for 10th through 12th graders who are “high risk” students. He added that the students are the ones who “could not function in the mainstream high school as they need a smaller setting.” He also stated that the ALC draws students from across multiple surrounding towns/cities, although most students are local. The school describes their mission is to provide students an opportunity to earn a high school diploma in a supportive, safe, and motivating environment that encourages hands-on learning and active participation.

In his reflective journal at the beginning of his first year as a science teacher, Anto described his duty as a teacher is “to place the knowledge to his students which they can recall when needed and use it in real life situations.” He also added: “teaching through inquiry, argumentation, discrepant events, and a comfortable learning environment are the factors which will help create a large group of excited learners.”

Anto’s views in the process of identifying his development as a beginning teacher is presented below under the three major themes: role as a teacher, teaching practice, and enhancing student learning.

Anto’s Developing Identity as a Teacher.

Role as a teacher. As he began his first year of teaching at King’s Academy, Anto considered his role to be someone who “delivers content knowledge” to his students. He also added that on a day-to-day basis, he saw himself in the role of a “guide” to his students leading them in the right direction. In an interview early in his first year as a teacher, he had the following to share regarding his role: “My role on a day-to-day basis

is to guide them in the correct way and give them my content knowledge that I have for them.”

As Anto continued into his first year in the classroom, this description of his role as a teacher did not change; however, he identified additional roles that he saw himself in. He acknowledged that developing academic skills was not his sole role, but instead saw himself as someone who wanted to provide students with skills that are essential for them which he termed as “life skills.” He stated:

I do a little bit of everything. I’m an advisor, so I’m teaching life skills. I’m teaching mental health, so I’m trying to improve their mental health. I’m teaching career readiness, I’m teaching how to learn information, I’m teaching three to four different sciences, and there’s a lot on my plate, but I do a little bit of that each day.

Towards the end of his first year, he mentioned that he gave his students “the tools” required to keep them focused. By tools, he meant that he was acting as a resource person providing the students with the materials required for learning and understanding. From observing him in the classroom, I noticed that while he used worksheets as a major source and lectured heavily, there were occasional demonstrations to engage the students. “In one scenario, I give them a wealth of knowledge. In the other scenario, I give them the tools and try to keep it student-led.”

During his second year of his teaching, Anto identified his role as a “guide”, where he was responding to students’ questions. He stated:

I guide and make sure that students are doing what they’re supposed to be doing, but otherwise I’m answering questions, asking questions, and things like that. I

just keep them on the straight and narrow path while they're working, and just keep reminding them that what we're doing here is reinforcing a concept that we've covered in class, which I think many of them tend to lose focus on.

In the middle of his second year, despite identifying himself in the role of a "guide," he began to see himself as a "dictator." He seemed to struggle in finding a balance in his role between being a "guide" and being a "dictator." He stated:

Sometimes I'm mediating and sometimes I'm dictating. You take all those positions on a daily basis. That's about it. When you're in a conversation, you're mediating it or you're guiding it where you want it to go. The rest of the time it's like this is what we're going to do, and there may be number of ways to do it and I'm going to leave that up to them.

When asked to clarify what influenced his decision in his role when being a dictator and a mediator, he stated:

Dictator is more along the lines... when you're transitioning, that's when you have to be in the dictator position. When it comes time to do a lab, especially a lab that has multiple different routes to get to that final answer, that's when you give the students x number of tools to get to that final step. That's more of a guide/mediator. They're asking you how do I get from point A to point D, and you just say, "you could do this but you might even be able to do that," like throw different ideas in there for them and let them run with it and see what they come up with.

In one of the classroom observations, I noticed that as he kept questioning the students on a lesson in ocean currents, there were hardly any responses from the students. When

students were asked how much more heat does the ocean absorb than the atmosphere, students were being passive listeners while Anto gave away the answers without redirecting to help students learn. He continued with explanations and provided answers without checking for all student understanding.

Towards the end of his second year, Anto described in his role as a “mediator.” To him, *mediator* and *guide* seemed to be the same as he used them simultaneously when talking about his role in the classroom. He described his role as a “mediator” stating:

I see myself mostly as a mediator. Sometimes I have to give a lot more instruction while we’re going through these labs or activities. Sometimes I feel like it is simple, like here’s the video, here’s what germinating is, and I just let them go with it. If they had questions, I would tell them what to do.

Talking about his role in the third year of his teaching, Anto mentioned that in the first year as he started teaching, all he could think of was trying to get through the year. But now, to him “student engagement and student learning” was more important. He added:

I think when you first begin as a teacher, you're just kind of like, you've got so many things going on that you're just trying to get through your year, you know, and get stuff done. Now, it's more- it's about student learning, it's about student engagement. For me, it's student engagement to student learning. Those are my biggest things... It's that your first year you're just trying to make it. Maybe even your second year you're just trying to make it. And it's kind of getting easier and easier. So, you can put more effort into what really matters. So, the first couple years are kind of challenging, this year has been a lot easier. And I suspect next

year will be even easier.

Overall in his first three years, I noticed that Anto exhibited multiple identities as he switched between being a “guide,” a “dictator,” and a “mediator.” Although he partly identified himself as a “guide,” his practices and his description on his role do not align with that of a “guide;” instead, it informs us of his role as a “dictator.” In the interview conducted at the end of his fourth year, Anto acknowledged that he was enjoying his role as a teacher at Kings Academy where his biggest change that he saw in himself was being able to connect with all of his students. He added:

I think my biggest change in my practice is, making sure that I am connecting with all the students and it's tough to do sometimes, but you know, I don't have students who are like being extremely diverse here. You've been here and you've seen it, so it's not extremely diverse in my program. What I do have is a mix up of like very quiet kids and some are so loud and I think they kind of air the quiet ones from like speaking up. So, like I try to connect with every single student on a personal level to help them and work with them and made sure that they're comfortable...but I can tell you that that's one of my big things, really connecting with each of these kids in some way about science.

Teaching practice: Balancing inquiry and lecture. At the beginning of his first year, Anto acknowledged that he found it challenging to teach his students as they were slow to understand the concepts. He added that his teaching practice was mainly lecturing and engaging the students in classroom discussion. While he primarily used lecture, he also tried to engage them in hands-on activities. He stated:

It's a challenge in my classroom with my students because we cover material a lot

more slowly in my class. I might cover a little less, but I'll cover it more thorough, and I give them the tools... like anything I introduce to them is by lecture, I try to show them with a lab as well, if I can. That's my best way. I spend a lot of time repeating myself or explaining it in a different way.

It also informs us of Anto's inward focus on his own actions. He added that his students learn best when he is able to support his lecture with hands-on activities:

It's either sitting and listening to me or practicing it. I tend to practice it and talk about it, but if you give them too much leeway, talking doesn't go very far. Only once in a while we get really good, solid discussions in the classroom, but like I said... I lecture to them and talk to them about it and question them about it and keep repeating the things that I really want them to learn. If I can back it up with a lab or an activity of some sort, then I really feel like I can start to connect the pieces for them.

Anto's statements from the middle of his first year contradicted his earlier ideas, as he no longer thought that students learned best during hands-on activities. Referring to his personal experience as a student, he continued:

They don't always grasp the idea when you're doing a lab, and I say it to them, too, because I remember doing labs as a high school student. You're going through the different steps, but in the moment, you're not connecting it to the lecture you just had the day before. Generally, I'll take the opportunity the next day to explain to the kids and break down the lab, and explain how that's related to this process. Then I'll move back and forward between lecture and lab, and try to connect the dots for them, because I feel like I don't remember teachers doing

that when I was in high school, and I'm sure they did, I just don't remember being taught that way.

Anto added that he spends a lot of time repeating himself or explaining concepts in a different way:

I generally do the same thing, but I'm always searching for as many activities and demos as I can. I'm not perfect and I can't do it every day, but I do enjoy bringing new and exciting information to the table for the kids.

At the end of his first year, Anto maintained that his students found inquiry to be challenging and added that he tried to engage them in "guided-inquiry" activities:

Most of my students can't handle student labs and inquiry is very challenging for them so it needs to be a guided-inquiry. I've tried to let them kind of go with it, but most of the time they just want you to tell them what to do.

In one of the observations at the end of his first year, Anto tried to engage the students in a hands-on activity on "seed dispersal challenge." The challenge for the students was to design a wind dispersed seed structure that will carry a single seed (Dried lima bean) the farthest. As they worked with a partner, they were allowed to use a single sheet of paper and the seed had to be fixed to their created seed structure which shouldn't fall out. For testing purposes, the completed seed designs were dropped in front of a fan, and the distance it travelled were recorded. Each seed/seed structures were dropped three times, and the average distance travelled for the three trials were calculated. The students had to record the average distance on a chart paper and had to refer to the chart during the whole class reflection session.

From his statements and observations, I understood that while Anto considered

his students learn best by having some hands-on activities, he tried to add a lab activity to his lecture when possible which informs us of his belief that his students learn it best when they are engaged in hands-on activities. While he kept insisting on engaging the students in hands-on activities, his actual classroom practice was heavy with lecture.

As he entered his second year of teaching, Anto strived to keep his students engaged by doing hands-on activities to keep them stay focused. He added:

I would do different activities interactively, whether it's through hands-on labs or a WebQuest. We have Chromebooks this year, so it will be a lot more online and a little more interactive stuff, not that I wasn't already doing that, but I try to do as much hands-on as I can and as much anything to basically back up some concept that we've talked about in class. It can be a movie, WebQuest, students designing their own labs... that's how I go about it.

He continued to insist that his students were more engaged doing hands-on activities. He added:

With the hands-on stuff especially, I have students engaged... a lot of them will actually take the notes if you're doing lectures or something, half of them will have their head down and half of them will write it all down, but most of them won't ever look at it. So, I've tried to shorten notes up and make them key points, but everything I give them is backed up with a hands-on activity.

Anto provided the following as an example of a hands-on activity in his classroom:

Ecology is a good example... we'll go out and collect samples, and you need to label samples, take temperatures of your samples, make observations on your samples, and stuff like that, so really what it's like out in the field. That's what I

think of when I think of hands-on learning. I also teach them about invasive species and while doing that, I'll have them create a wanted poster of a certain type of invasive species. They do all the background work and answer some questions about that species on their poster. Things like that, that's hands on to me.

As he completed his second year of teaching, he maintained that his teaching practice involved engaging students in hands-on learning. He added, "It's doing as many hands-on projects as I possibly can and make sure that they're getting the major content to go with it, but as much hands-on learning as possible." He provided an example of a recent hands-on experience with his students where they were involved in planting. He continued stating:

We have a plant science class going on right now. At the high school, we have a garden, and we developed an experiment that will take up a space in the planter box. Yesterday morning we met over at the garden and we set it all up. We don't have anything planted yet, but today we took all the seeds that we wanted for different plants in our garden and we got the seeds set up to germinate. We're doing the little things and little steps. That's actually working out nice because setting up all the seeds and stuff today only took 20-30 minutes. They watched a video about how to do it first, then they did it, and then they got some content thrown at them in a short lecture. They have really been loving all the stuff we're doing with the plants.

As Anto entered his third year of teaching, it was evident that he became more comfortable with the school culture and the needs of his students which were echoed in his

instructional practice when he was being observed. He maintained that his teaching was a mix of both lecture and hands-on which served as a vehicle to keep the students engaged and transfer the information to them. He stated:

My teaching is a mix. Some lessons lend themselves really good to hands-on learning. Some of them are just listening to me. Some of them are, it's either me lecturing, it's hands on, it's a lesson followed by some videos, it's... So, I don't know what words you use to describe those, but it's a mix. It's never all the same thing. I use, different vehicles to get the information out to them.

In one of his post observation interviews in the third year, he said:

Oh! Definitely improved. You know when you come into a job like, when you first come in... you don't necessarily have the management piece down yet, but I kind of figured out these kids and how to deal with a lot of these kids. So, because I have that positive rapport with the students a lot of them like this the stronger personalities within a big group, like they look out for you too. So, they say help set expectations with other students which I think makes it easier to teach in a better learning environment for them.

Anto consistently identified his teaching to be a balance of both lecturing and hands-on activities to keep his students focused and engaged. He continued stating:

I think when you first begin as a teacher, you're just kind of like, you've got so many things going on that you're just trying to get through your year, you know, and get stuff done. Now, it's more like, it's about student learning, it's about student engagement. For me, it's student engagement to student learning. Those

are my biggest things.

Enhancing student learning. In his first year of teaching, Anto professed that he strived to enhance students' learning by engaging them in hands-on learning followed by students explaining it to help them understand better. He stated:

I know they can understand if they can openly discuss it with me at some point, or help one of their peers with the information. That's kind of what I aim to do in class. If I can get students helping each other, then I really know that they're starting to learn it. It could be pairs or small groups, but sometimes it's just that we're openly working on it during class time. It might be working through something, and students that just happen to have it down, will begin to help other students. I'll have them discuss amongst each other and see where they're at.

In the middle of his first year of teaching, Anto acknowledged that he was trying to encourage the students to explain to each other as a part of learning. He stated:

If they can have an engaging discussion about a topic and start to use some terms and everybody's getting it and talking about it, then I feel like we're getting it.

Either way we're getting it or we're really intrigued by the topic.

Towards the end of his first year, he went onto say, "I will do a lecture or something, and then we do some sort of activity or lab to back that up, and then again we debrief about how the lab or activity is connected to my lecture." He continued stating:

The idea there for me is I can ask them open-ended questions that they can actually put some thought into and really tell me the concept here, like this is what we were trying to do and this is what we maybe could have done better.... I want them to be able to give me a concept and explain that concept to me, which tells

me that they've learned it.

One such example were students explained to him was on cell biology. Anto gave the option that in order to prove their understanding, they had to take a practical using pipe cleaners and a small dry erase board. The dry erase board was considered as a cell and the pipe cleaners were considered as chromosomes. The students had to teach it to Anto and explain to him as to what was happening. Anto assisted the students through it, and to him, this enabled the students to show their mastery on the topic.

As he entered his second year of teaching, while Anto continued to emphasize the need for student explanation in his classroom to enhance students learning by saying that his students understand a topic much better when they can “openly talk about it and converse with him,” in the middle of his second year, he insisted on the need for hands-on learning along with explanation. He stated:

I do a lot of hands-on learning, as often as possible, that is how in my mind I maximize student learning. I lecture about it for about a half a day, maybe even a day, then we get hands-on stuff, we connect those connects the whole time, we keep talking about it, and then some kind of assessment to see what's been learned. I feel learning is maximized through hands-on experiences and connection to the content.

Anto acknowledged that he was comfortable working with his students as he felt more connected to them. He stated:

Now it's more like I take everything I'm preparing to teach and I look at it from every angle. How I can touch every student in the classroom through my teaching, maybe not every student every day but in some way, shape, or form

connect what I'm doing with every single student in the classroom no matter what.

At the end of his third year, when reflecting on his development as a teacher over the last few years, Anto acknowledged that he had been working on focusing on student interaction and engagement which comes down to the content being taught and the way it was presented. Overall, it could be noticed that Anto identified that engaging students in “explanation” along with hands-on activities enhances student learning.

Summary

This concludes the analysis of individual teachers based on how they perceived their identities in terms of the three themes: role as a teacher, teaching practice: balancing lecture and inquiry, and enhancing student learning. A cross-case analysis is further explored and presented in Chapter 5 on the similarities and differences of the identities amongst the three teachers, concurrent to the conclusions, and implications of this research.

CHAPTER 5: CROSS CASE ANALYSIS, CONCLUSIONS, IMPLICATIONS, AND FUTURE RESEARCH

This study aimed to provide a better understanding of teacher professional identities which enabled the beginning teachers to reflect on their practices that help build an understanding of their continuous process of science teaching development thereby expanding the literature. The research questions that guided this study were:

1) How do beginning secondary science teachers professional identities develop over their first three years in the classroom?

a) How does reflection on beliefs and practices mediate that transition?

This chapter presents a cross-case analysis of the identity development of beginning teachers across the three cases. The chapter is organized by presenting an analysis of the research questions starting with the cross-case themes through the lens of the professional identity framework across the three teachers. Finally, conclusions, implications and future recommendations on teacher professional identity development are discussed.

Cross-Case Analysis

As the purpose of this study was to understand the developing identities of the participating science teachers over their first three years in the classroom, the teacher identity framework described in Chapter two (Figure 2.1) served as a lens for examining the development of teachers professional identity across the three teachers within each individual's school context. The focus on professional identity from the framework affords a lens in which the developmental shift of one's identity is considered in light of how it impacts one's professional practices, values, beliefs, and commitments. The three

major themes that emerged from the individual case analysis served as the themes for the cross-case analysis as well. The three major themes include: role as a teacher, teaching practice and enhancing student learning.

Role as a teacher. In examining the developing identity of the three teachers in this study, new teachers described their professional identities at times through the metaphors such as “manager” and “dictator” which they choose to represent their teaching selves (Thomas & Beauchamp, 2011). Although the three teachers used terms like “facilitator,” “manager” and “guide” to describe their role as a beginning teacher over the course of the years, there were some changes which are shown in Table 5.1.

Table 5.1. Identified roles of Alex, Sue and Anto

Teacher	Year 1			Year 2			Year 3
	Fall 2015	Spring 2016	Summer 2016	Fall 2016	Spring 2017	Summer 2017	Summer 2018
Alex	facilitator/ authoritative	facilitator	manager	facilitator	authoritative	guided- facilitator/ authoritative	authoritative/ guide
Sue	facilitator	facilitator	facilitator, Stage manager coach and mentor	facilitator	facilitator	organizer/ facilitator	facilitator
Anto	guide	advisor/ mentor	resource person	guide	guide/ dictator	mediator	guide

While Alex and Sue started off describing their role as a “facilitator” at the beginning of each academic year, they became more *authoritative* towards the end of the year. This was seen as a result of “classroom management” and “behavior issues” that these teachers struggled with at the start of the year. Unlike Alex and Sue, Anto at the start of

his career identified himself as an “guide” who acknowledged that “there was a lot on his plate” as he had to teach “three to four different sciences.” I noticed that over the course of the years, Anto exhibited multiple identities as he switched between being an “advisor,” a “guide,” a “dictator,” and a “mediator.” Alex who did not want to be “authoritative” in the classroom, chose to be a “guided facilitator” at the end of his third year. However, over the course of the first three years, he identified himself going back and forth between being a facilitator, manager and a guided facilitator. Students disengagement and behavior issues had an influence on his role in the classroom. Taking into account the school context that he was working in, he also expressed that he could “go much faster with much less behavior issues” which showed his frustration towards classroom management. Similar to Alex, Sue despite recognizing the need to be a facilitator, embraced the role of a “manager” in order to have control over the kids in her classroom. She saw herself doing “lot more behavior management than teaching” as she continued to struggle with behavior problems which was one of the major components of student disengagement in her classroom. As Wenger (2010) suggests, the identity shift in these teachers, occurred based on the school context and environment they found themselves in.

Unlike Alex and Sue, who at some point identified themselves as *authoritative* due to their school context, Anto considered himself as a “guide” and an “advisor” except at the end of his second year where he identified himself as a “dictator.” Anto’s school atmosphere was different than the other two teachers Alex and Sue as his students were enrolled in the alternative program. To Anto, his students “could not function in a mainstream high school as they needed a smaller setting.” The findings indicated that all

the teachers had to deal with classroom management issues and this forced them to take up the “manager” or a “dictator” role. However the ways in which they dealt with the classroom management issues were different as they adopted different teaching practice leading to different outcomes.

The teachers identities shaped their responsibilities and performance as a classroom teacher where they were obligated to consider students behavioral issues and their abilities of understanding. It is to be noticed that the teachers professional identities have shifted from the first year to third year, from being a “facilitator” to being more “authoritative.” Alex and Sue’s identity shifts inform us that it was a part of their “constant becoming” (Wenger, 1998, p. 154). All the three teachers in the study acknowledged their role as a teacher and how they perceived their identities in the ongoing process of development as a beginning teacher. As these teachers reflected on their identity, it served as an important part of securing their commitment to work which shaped their dispositions (Hammerness, Darling-Hammond and Bransford (2005).

Teaching practice: Balancing inquiry and lecture. Being an effective teacher requires the implementation of teaching strategies that best meet students’ individual needs. In examining the teachers responses as to how they identified their teaching strategies employed by them in their classrooms, I identified that teachers had varied strategies that they considered worked for them and their students (see Table 5.2).

Table 5.2 Teaching practice employed by Alex, Sue and Anto

Teacher	Year 1			Year 2			Year 3
	Fall 2015	Spring 2016	Summer 2016	Fall 2016	Spring 2017	Summer 2017	Summer 2018
Alex	inquiry/ scaffolding	lecture	inquiry/ lecture	inquiry/ lecture	structured style	inquiry	guided- inquiry
Sue	hands-on	hands-on/ lecture	direct instruction	project based	inquiry/ lecture	inquiry/ routines	inquiry/ routines
Anto	lecture/ lab	hands-on/ lecture	guided- inquiry	hands-on	hands-on/ lecture	hands-on/ lecture	guided- inquiry

All three teachers Alex, Sue and Anto described their students’ abilities and readiness to work through challenging material. They continued to reiterate and assert that the students resisted challenging learning experiences which forced them to switch between “lecture” and “guided inquiry.” This dynamic process of identity is thus revealed in the duality of student-centered and teacher-centered instruction.

Engaging students in inquiry activities included its share of frustrations. At the beginning of his first year, Alex had tried various “inquiry” based activities and came to the conclusion that inquiry did not work for his students; it not only interfered with the classroom management and behavior issues but the students were not prepared and capable of taking up challenging activities. He therefore slid into a “lecture” based teaching to maintain sanity in his classroom. Like Alex, Sue saw a shift in her teaching practice throughout her first year. She moved from employing “hands-on activities” to implementing “direct instruction” in her classroom as she faced behavior management

issues. For this reason, they both preferred to move away from focusing on inquiry activities. The belief that students gave them a hard time in implementing student-centered instruction led to their description of instructional practices that were more teacher directed at times. While classroom management issues forced them to choose teacher-centered instruction, it was not how they identified themselves as. Rather, both Alex and Sue continued to express their desire to implement student-centered instruction and ultimately moved back toward inquiry practices. By the end of their third year, both Alex and Sue were able to restart implementation of inquiry based activities as they tried various strategies in order to overcome classroom management issues. Conversely, Anto started off his teaching practice in the first year by employing “lecture” as an approach while trying to balance it with “hands-on” activities whenever possible. Anto’s practices unlike Alex’s and Sue’s aligned with his beliefs where he saw himself as one who “delivered content knowledge” to his students.

It is to be noted that Alex’s teaching practice of inquiry related activities was strengthened as he received support from his school principal who promoted and provided professional development opportunities for inquiry implementation. Whereas Sorcha’s teaching practice as a new teacher was influenced by the school policy regarding classroom management issues where she had to keep track of the number of times students had to be warned for their wrongdoings before they could be reprimanded. As these beginning teachers faced a variety of daunting challenges (Goldrick, Zabala, & Burn, 2013; Luft et al., 2011) when implementing inquiry-based teaching they managed to find a balance in adopting their teaching strategies to their school context and the needs of their students. Hence it can be seen that the teachers had different reasons

depending upon the varied needs of the students for using “inquiry” in their classrooms provided the school context also played a major role in informing the teachers of the practices they chose to employ.

Research has established that the early career phase is particularly challenging, so much so that many “new teachers spend a disproportionate amount of time and effort simply [keeping] their heads above water” (Fantilli & McDougall, 2009, p. 814). The teachers’ reflection on their development of professional identity formation with regard to teaching practice is often exhibited as a continuing struggle in all the three teachers as they had to make sense of their students’ perspectives in connection to their learning, expectations, and their own roles that they have to confront and adapt to (Samuel & Stephens, 2000; Volkman & Anderson, 1998). Hence enabling teachers to articulate their thinking about teaching through reflection can be a powerful way for them to understand themselves better in terms of the school contexts in which they work (Thomas & Beauchamp, 2011).

Enhancing student learning. The three teachers had different visions for enhancing student learning. The cross case comparison is shown in Table 5.3. Teachers are assigned with the role of designing learning environments and facilitating students’ learning through a variety of approaches (Mokros, 2003). As the teachers employed various approaches to teach, it enabled them to focus on fostering and enhancing student learning which is an important factor in teaching and learning.

Table 5.3 Approaches to enhance student learning by Alex, Sue and Anto

Teacher	Year 1			Year 2			Year 3
	Fall 2015	Spring 2016	Summer 2016	Fall 2016	Spring 2017	Summer 2017	Summer 2018
Alex	scaffolding	questioning/ scaffolding	scaffolding	scaffolding	scaffolding	scaffolding	scaffolding / questioning
Sue	group work	group work	collaborative work	group work	group work	group work	group work/closure
Anto	student explanation	student explanation	student explanation	student explanation	student explanation	student explanation	student explanation

Alex described “scaffolding” and “questioning” to be an intentional way to enhance student learning. Alex started off his first year by using scaffolding as a technique to enhance students’ learning. Eventually, he decided to improve working on his questioning skills as a part of scaffolding, as he realized that most of the times the questions that he asked his students were not the ones he wanted to ask in the first place. While reflecting on his developing identity, he recalled that the questions he asked his students initially did not yield the responses that he wanted to. Alex desired for his students to be able to generate their own explanations from data. As he chose to get back to inquiry after trying out lecturing, he realized that improving his questioning technique was central both to being able to use inquiry and have students learn how he wanted them to. As Alex continued to work on enhancing student understanding, he identified himself getting better at scaffolding. By the end of the third year, he identified himself as using

scaffolding and questioning techniques simultaneously thereby helping his students gain better understanding in the learning process.

Sue's approach to enhance students' learning was constant throughout the study. Sue emphasized collaborative work where the students get to explain the concepts learnt to each other. To Sue, when students were engaged in collaborative/group work, learning was both constructive and efficient as it helped them identify their misconceptions, learn new skills and strategies through peer interaction (Vass, 2007) thereby gaining confidence. It is also noteworthy from the table above (Table 5.3) that Sue's approach in enhancing students learning was employing either collaborative or group work. To Sue, group work was when students were engaged mostly in discussion or writing as part of an activity, while collaborative work was when they were assigned different roles to complete a task or an activity. Encouraging and engaging students in collaborative work was a central belief that Sue held to in spite of the continual contextual change. The static nature of her approach might be due to the school context that she has been working in during the first two years where she had to shift from one school to the other. Apart from becoming familiar with the school itself, Sue was positioned in a way to restart every academic year with students in different grades owing to the lack of support and co-operation with her fellow science teacher. This made her try and re-try the approaches every year in order to figure out what worked best for her and for her students which could be the reason behind her static approach of employing group work year after year.

Anto on the other hand, instilled engaging students in "explanation" to enhance student learning. For him, explanation meant that students had an engaging discussion about a topic or could openly talk about it and converse with him. While his school

context was different from Alex and Sue, Anto chose to maintain that ensuring students to provide explanation either be it in an one on one discussion with him or a whole group discussion enhanced their learning. It is to be noticed that Anto's approach to enhance student learning was seemingly in line with his practices where he believed in delivering content knowledge by primarily employing lecture while the use of labs were to promote student engagement, as opposed to learning.

The above discussion from all the three themes informs, as identity is a dynamic, multifaceted, and evolving concept that can be influenced by experiences (Avraamidou, 2014), the approaches that teachers take in a classroom to enhance their students learning and engagement depends upon their school contextual factor, the nature of the learner population, the belief toward teaching and learning and their own experiences as learners in schools (Beauchamp & Thomas, 2009).

Conclusions

The beginning years in the profession forces new teachers to confront their professional identities on a regular basis and in multiple ways. Beginning teachers are constantly confronted with factors such as classroom management, which impacts their sense of self as successful or not in the role of teacher (Thomas & Beauchamp, 2011). The cases provided information on how these teachers not only identified their development in their beginning years towards teaching and learning, but also reflected on their practices that help build an understanding of their continuous process of science teaching development. The findings of the study revealed specific changes in the developing identity of beginning secondary science teachers as they reflected on their beliefs and practices. Alex and Sue reverted to direct instruction during their first and

second year but over time they developed routines and pedagogical strategies to implement more student-centered, hands-on lessons aligned with their identity as facilitator. Anto maintained his teaching practice throughout the three years to be primarily “lecture” with an occasional “hands-on activity” to promote student engagement. This traditional practice was aligned with his beliefs about his role as a teacher and how students learn in spite of his stated identity as a “guide.”

Although there are studies indicating that teacher-espoused beliefs are consistent with classroom practice (Haney & McArthur, 2002; Levitt, 2002), there have been some studies indicating that teacher beliefs do not necessarily influence classroom practice because of several factors (Hancock & Gallard, 2004). In the cases of Alex and Sue, they believed that engaging students in student-centered instruction such as inquiry based activities enhanced their critical thinking skills, but the students’ unwillingness to work on challenging materials which led to behavior issues often forced them to fall back into teacher-centered instruction. This study presented some relevant insights into similarities and differences among teachers’ perceptions of their professional identity, including changes in identity in the beginning years of their careers.

As the teachers reflected on their beliefs and practices, it enabled them to shape their planning and curricular decisions, in effect determining what should be taught and what path instruction should follow. This way articulating their thinking about teaching through reflection can be a powerful way for teachers to understand themselves better in terms of the contexts they work. Reflective practice process can therefore bring to teachers’ attention their practices that they do intentionally or unintentionally.

Teachers beliefs provide a strong basis for their classroom actions and in order for teachers to create successful opportunities for the students, it is important to reflect on their own beliefs. The teacher identity framework (see Figure 2.1) indicates that as beginning teachers reflect on their beliefs and practices, it provides them the opportunity in transforming their identities to enhance their teaching as teachers and their students learning. Hence this study enables us to see their developing professional identity and the transition which is mediated through reflection as they move toward and into practice. Teachers therefore should reflect on their classroom practices to promote consideration of their underlying values and beliefs about teaching and learning (Farrell, 2008). Engaging teachers in such reflective practice enables them to articulate to themselves (and others) what they do, how they do it, why they do it, and, ultimately, what the impact of one's teaching is on student learning.

Implications

This close analysis of teachers' identity supports a better understanding of teachers' active construction of professional identity in their career. The findings presented here support that teachers' professional identity experiences are intimately connected to their willingness to implement various strategies in teaching to help their students learn and grow within a changing professional environment (Beijaard et al., 2000). This specific research can help inform teacher educators the importance of reflection as they work to prepare future teachers and support in-service teachers in shaping their beliefs toward teaching in their classroom. Moreover, the support in reflective practice should be provided to beginning teachers for at least a period of three years rather than just in their first year. If at all the supports were only provided in their

first year, these new teachers might tend to stop trying and grow into the teacher they want to be, and remain as traditional teachers. By engaging in reflective practice, teachers can therefore construct and reconstruct their own beliefs and practices so that they can provide optimum learning conditions for their students.

Curricular spaces for critical race reflection and dialogue must be established to prepare white teachers to work in diverse, urban schools. By providing such spaces, pre-service teachers would be provided the opportunity to recognize unjust race relations as they can be mediated by subject matter experts. Racism needs to be addressed in teacher education programs. When teaching content related to race, teacher educators should also focus on the emotional needs of the students of color (Matias, 2016) rather than focusing on the emotional needs of white students. Beginning teachers require support as they face the challenge of effectively teaching diverse students in their classrooms. Hence professional development must occur in order to bring culturally relevant issues, topics, and knowledge into their classrooms.

As teachers gain professional experience, they need ongoing opportunities to reflect on their development toward teaching and learning (Jones & Leagon, 2014). The beginning teachers also need opportunities to understand their own personal and professional identities in relation to racialization and other intersecting sociocultural processes. Knowing that the professional identity of teachers can be reshaped, we must continue to consider the situation of teachers in the early years of practice, where the influence of their surrounding context – the nature of the educational institution, teacher colleagues, school administrators, their own students and the wider school community – is strongly felt.

Future Research

More research is needed in order to understand if and how these developing identities corresponds to classroom actions as the teachers gain experience and the impact of these identities on students' interest and learning science. It should be noted that various factors also must be considered when exploring their developing identity as they reflect on their beliefs and practices. Teacher education and teacher background, school community including administrator, parent and student perspectives and other factors such as the need to cover curriculum and preparing students on exams are some of the possible factors that may influence teacher beliefs and classroom practices about teaching and learning, which needs more research.

Furthermore, more research could be done to investigate the effect of other factors such as beliefs about student-centered teaching and beliefs related to school and community culture. They also need opportunities to compare their personal beliefs and practices with colleagues. The results of this study demonstrate a need for further research to investigate the relationship between teacher's beliefs and their classroom practices. Further, an in-depth study of a number of teachers in this study would be an useful addition to this research. This study could be extended in determining the influence of the teachers identity development on their students learning.

Closing Remarks

To conclude, the concept of teacher professional identity development can offer a useful theoretical framework for future research on teacher identity and teacher–student interactions/relationships. Rodgers and Scott (2008) have pointed out that much current research into the development of teaching identities does not indicate how identity

develops and how teacher educators might influence this development. It is highly likely that the beginning years of a teachers will remain demanding, but the more we as teacher educators can learn about the process of developing a teaching identity, the better we can help future teachers prepare to meet these demands in a positive and professionally satisfying way.

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APPENDIX 1: TEACHER BELIEFS INTERVIEW PROTOCOL

Adapted from:

Luft, J. A., & Roehrig, G. H. (2007). Capturing science teachers' epistemological beliefs:

The development of the teacher beliefs interview. *Electronic Journal of Science*

Education, 11(2).

1. How do you maximize student learning in your classroom?
2. How do you describe your role as a teacher?
3. How do you know when your students understand?
4. In the school setting, how do you decide what to teach and what not to teach?
5. How do you decide when to move on to a new topic in your class?
6. How do your students learn science best?
7. How do you know when learning is occurring in your classroom?

APPENDIX 2: STIMULATED INTERVIEW QUESTIONS

1. Describe how your thinking about science teaching and teaching practices have changed over the past three years?
 - In what ways do you think you have improved in your teaching over the past three years?
2. What stood out to you when watching each video? How well does the video exemplify your day to day teaching?
3. Was this a good lesson? (How do you define a good lesson?) What evidence points to it being a good lesson? What would you do differently in the future?
4. What did you learn about your teaching and how your teaching has changed over the past three years from watching these videos?
5. What did you learn about student thinking from watching the videos? Was it similar or different than you expected?
6. In your M.Ed. program, we frequently asked you to collect and reflect on video. How has video helped you to grow as a teacher?
7. What further improvements do you plan to work on in the future?
 - What are your teaching goals for this year? Do you think that this has changed since the beginning of your role as a teacher? If so, how and why?