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Evolution of Teacher Leadership: The Influence of Leadership Professional Development Opportunities on Teacher Leaders' Perceptions of Their Leadership Characteristics, Professional Vision, and Professional Identity

Tugce Gul

ACCEPTANCE

This dissertation, EVOLUTION OF TEACHER LEADERSHIP: THE INFLUENCE OF LEADERSHIP PROFESSIONAL DEVELOPMENT OPPORTUNITIES ON TEACHER LEADERS' PERCEPTIONS OF THEIR LEADERSHIP CHARACTERISTICS, PROFESSIONAL VISION, AND PROFESSIONAL IDENTITY, by TUGCE GUL, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education and Human Development, Georgia State University.

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EVOLUTION OF TEACHER LEADERSHIP: THE INFLUENCE OF LEADERSHIP PROFESSIONAL DEVELOPMENT OPPORTUNITIES ON TEACHER LEADERS' PERCEPTIONS OF THEIR LEADERSHIP CHARACTERISTICS, PROFESSIONAL VISION, AND PROFESSIONAL IDENTITY

by

Tugce Gul

Under the Direction of Kadir Demir

ABSTRACT

The importance of teacher leadership has received intense interest as an area of educational research over the past three decades (Crowther, Kaagan, Ferguson & Hann, 2002; Harris, 2003; Lambert, 2002; Marks & Printy, 2003). Most of this research has focused on the qualifications, impacts, and development of teacher leadership (Smylie & Mayrowetz, 2009). This study aimed to broaden the scope of research to include science teachers' interaction with leadership practices in the course of a leadership development program that includes both their own professional development (PD) and leadership of teacher-driven professional development (TDPD). The study considered professional vision and identity rather than focusing only on formal or informal leadership roles. The purpose of this qualitative case study was to examine experienced physics

and chemistry high school teachers' perceptions of their leadership roles and characteristics and their professional vision and identity as they participated in a leadership development training program and a math and science partnership program as facilitators of the science activities for K-12 teachers. The study was situated within the leadership training program (I-LEAD) five-year project, which was designed to recruit experienced secondary physics and chemistry teachers, called Master Teaching Fellows (MTFs), to understand the dynamics that support or limit the development of teacher leaders. The participants in this study consisted of up to three of these MTFs, who organized and implemented TDPD activities for K-12 teachers to improve these teachers' science knowledge and teaching practices. The data was analyzed using multiple coding methods that generated themes from interviews with the MTFs and archival data from the I-LEAD leadership program. The results of the study claim that professional vision, professional identity, and teacher leadership roles and skills are inextricably interrelated. These dynamic components are refined, reshaped, and reformed by self-reflection, discussion, and feedback as provided through PD activities. This study further suggests that teacher leadership mechanism evolves over time through practicing different teacher leadership roles in the professional journey. Implications and practical suggestions for school administrators, PD developers, and policy makers as well as teacher leaders are discussed.

INDEX WORDS: Teacher leadership, Professional development, Professional identity, Professional vision, Teacher-driven professional development

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to my DAD...

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ABBREVIATIONS

TL	Teacher Leadership
PV	Professional Vision
PI	Professional Identity
PD	Professional Development
TDPD	Teacher-Driven Professional Development
SI	Symbolic Interactionism
MTFs	Master Teacher Fellows (Participants)
PLC	Professional Learning Community
MSP	Math and Science Partnership
I-LEAD	The Leadership Training Program

1 INTRODUCTION

I taught at one of the best urban private schools in Istanbul, the largest city in Turkey. This private educational institution was comprised of kindergarten, primary school, and high school. I worked at the primary school for almost two years as a full-time elementary teacher. In this school, leadership was not the sole responsibility of administrators and the principal; some teachers (i.e., unit leaders) were involved in the leadership and management of the school. This model meant that leadership within the school became a collaborative effort between administrators and teacher leaders. Each grade level team had a teacher leader, who was more experienced and has more leadership capacity, than the other teachers, and frequently communicated with the principal to make reasonable decisions for lesson plans, parental interactions, bulletins, and so forth. This collaboration and sharing of roles allowed teachers to better anticipate obstacles to improving the system as well as to formulate plans for overcoming barriers. Further, I realized that this network system with teacher leaders played a significant role in what strengthened the relationship among the groups/teams. This network system was presenting what each teacher valued and how he or she worked cooperatively to accomplish the identified school goals. As a teacher, I observed and voluntarily assisted our team leader. Through collaborative experience, I learned some basic teacher leadership roles from our group leader, including but not limited to defining what students need to know, finding and applying resources, sharing new ideas with colleagues, creating partnerships with colleges, and dealing with the change process.

The education I have attained and my research experiences have enabled me to delve into the philosophical, theoretical, and organizational aspects of the field (PD for teachers). In my master's thesis, I focused on the perceptions of elementary teachers relative to the value of in-

service training for adaptation to social development in the process of globalization. My aim in selecting this topic was to understand the quality and effectiveness of PD programs for elementary teachers considering pedagogical and content aspects. The results of my study illustrated, within the process of rapid and effective global developments, that PD programs have great importance especially for the K-8 teachers, who need to be supported either for their personal and professional improvement or for adaptation to ongoing developments. The results of the study and my observations during data collection, however, illustrated that PD programs were insufficient in dealing with issues such as technology and science. The need for reform was evident as well as the need for effective teachers to move the school community in the direction of effective teaching and learning practices (Gul, 2008).

To build on those experiences, I have been continuing to work in teacher development during my doctoral studies in an urban university in the southeastern United States. During this time, I have been working on *the leadership training program* (I-LEAD- as pseudonym) five – year project, which was designed to recruit experienced science teachers (physics and chemistry majors), called Master Teaching Fellows (MTFs), to participate in monthly professional development sessions. Those sessions were designed to give the MTFs the skill sets necessary (both instructional and leadership skills) to be agents of change and to influence other teachers' professional approaches locally, regionally, and nationally. One of the purposes of I-LEAD was to understand the dynamics that support or limit the development of teacher leaders. Two cohorts of the MTFs enrolled in a five-year PD program designed explicitly to facilitate that development. In April 2012, project developers encouraged the first MTF cohort to focus on creating and clarifying group goals to be accomplished by the end of the project. The goals the first cohort of MTFs developed for the I-LEAD projects were as follows:

- Deepening their own content and pedagogical content knowledge
- Improving instructional strategies based in levels of study
- Developing a framework for engaging in a mentoring/induction program to encourage professional development of novice and pre-service teachers
- Organizing teacher driven professional development (TDPD) to do outreach to elementary, middle and high school teachers with PDs (presentations, resources, etc.)
- Becoming change agents in department/school/county/state
- Developing data analysis methods to capture the impact and effectiveness on teaching

One of the goals that sparked me was "Teacher driven professional development". They aimed to facilitate outreach activities to other teachers (elementary as a priority) to support raising the quality of other teachers' science practices. The MTFs discussion regarding this goal was very insightful and realistically associated to the literature that indicates teachers (K-12) are in need of PD in science teaching. At the elementary level, for instance, science teaching is a neglected area for teachers (Bilbens, 2001) and is pushed into the background while teachers focus on other fields, like math and reading (Mulholland & Wallace, 1996; Stevens & Wenner, 1996).

Thus, my educational and professional background and experiences as well as the literature on teacher PD and teacher leadership enlightened me about the importance of teacher leadership, and motivated me to focus on a) how teacher leaders understand their role as teacher leaders; b) what experiences influence teachers' leadership roles and attributes; c) how professional vision influences teacher leaders' performance; d) how professional identity influences teacher leaders' performance; and e) how teacher leaders reconstruct their

professional vision, identity and leadership characteristics while improving other teachers' (K-12) instructional science knowledge.

Moving Forward to the Problem

Teacher leadership progressively becomes a key vehicle for school improvement as teachers share leadership roles while implementing and supporting school improvement initiatives (Criswell & Rushton, 2013). Research studies state that teacher leaders evolve as a result of specific leadership expertise. Lieberman, Saxl, and Miles (1988) described this expertise as report writing, organizational judgment, providing guidance to find and implement resources, adapting easily to the developmental process, dealing with leadership responsibilities, and creating confident and positive learning environments for both teachers and students. Mentoring, as one of the formal teacher leadership roles, is perceived as the starting point of leadership. That is, leadership responsibilities for teachers create a space for mentor teachers to display their leadership potential and thus enrich the value of the school culture (Ensher & Murphy, 2006). According to Katzenmeyer and Moller (2001), teacher leaders' roles not only encompass classroom efforts but also contribute to a community of novice and more experienced teachers as leaders provide continuous improvement to teaching and learning practices. Teacher leaders, therefore, need to be inspired and supported to be capable of leading and encouraging colleagues within positive relationships in the learning environment. From this perspective, mentor teachers who take formal leadership roles and have a closer connection to the administration have potential to support the developmental process of other teachers in the same school culture. Becoming a mentor teacher demands commitment and a desire for improving the entire school-learning environment (Msilia, 2012). This claim shows that although mentoring experiences are worthy ways to learn about leadership practices, mentoring does not become a

solution in itself for school challenges and/or helping colleagues' improve since a mentor's mission is limited to helping novice teachers (either student-teacher or new/novice teachers). Roby (2011) emphasizes that elementary, middle and high school teachers' leadership has potential to inspire school culture to create a fruitful learning environment. Thus, to increase their impact in creating a fruitful professional learning atmosphere for all teachers not just novice teachers, mentor leaders must transition their leading abilities from mentorship to leadership.

Related to teacher leadership in a broader context, Roby highlights positive impacts of teacher leaders in creating continuous learning for other teachers and the school system. Further, Can's (2009) research identified teacher leadership as taking over voluntary responsibilities during educational processes and activities, establishing independent projects, inspiring colleagues, and developing professional learning communities to effectively carry out joint requirements with colleagues. Thus, this study focused on the MTFs' leadership performance beyond their leadership roles in their own schools as a mentor or a leader. It is important to note here, MTFs' leadership experiences (both mentoring or other leadership activities) in their schools were very important in terms of preparing them to better perform as leaders while doing outreach to other schools' teachers such as being charge of Math and Science Partnership teacher training program. The MSP program's target was to improve teacher quality through professional developments for teachers to increase the academic achievement of variety of grade level students (3^{rd}-12^{th}) in mathematics and science.

In association with improving leadership skills of teachers, two important types of support are mentioned in the literature: school culture support and PD support. When school cultures allow teachers to participate in the decision-making process, teachers' leadership skills become more effective in developing problem solving and interactive communication (Buckner

& McDowella, 2000; Gehrke, 1991). However, cultural differences between schools impact teachers' leadership roles, either in a constructive or an unconstructive way. When school leaders do not provide positive support, teacher leaders need external PD programs (e.g., Can, 2009). In Can's study, the teachers defined themselves as insufficient in leadership behaviors. Similarly, Katzenmeyer and Moller (1996) claimed that teacher leaders need support to overcome some obstacles, like building new relationships with colleagues and learning to accept and respect colleagues' insights. Accordingly, when teachers are trained, they develop their own leadership characteristics and also benefit other teachers and students (Loucks-Horsley, Love, Stiles, Mundry, & Hewson 2010; Lord & Miller, 2000; Katzenmeyer & Moller, 2001).

Leading professional development is valuable in improving teachers' leadership capacities. Professional development programs are also valuable for teacher participants, especially in science teaching and learning. Many research studies indicate that teachers, especially at the elementary level, do not have proper views of science and related instructional strategies. In addition, they seek support and collaboration with other teachers and the community. Professional development programs, thus, can help to improve elementary teachers' content knowledge and teaching practices in science (Akerson & Hanuscin 2005, 2007; Akerson, Hanson, & Cullen, 2007; Bentley, 2003). In this point, the MTFs' goal, outreach for other teachers, becomes meaningful. As the reason for creating this goal, the learning and developing process is not internalized unless teachers are putting it into practice. Thus, teacher leaders must also put into practice their evolving leadership characteristics, especially when there is a need and gap in a particular level (i.e., elementary and/or middle school science teachers' shortcomings in science teaching).

Hiebert, Gallimore and Stigler (2003) justify the importance of teachers' responsibilities for improving their own teaching and the shared practice of the profession. If teachers are open to sharing their own instructional experiences with their colleagues, it allows teachers an opportunity to establish networks and take advantage of innovative practices. PD programs provided by experienced teachers (e.g., MTFs), called teacher-driven professional development (TDPD), can improve teaching practices and facilitate a rewarding way for other teachers to gain benefits from colleagues no matter what grades they teach. As they experience parallel struggles, they can understand each other and address their needs. Their lived experiences, in both teaching and PDs, can inform PD programs and support professional growth of teachers to be mutually beneficial.

Thus, this study focused on PD activities provided by I-LEAD program for MTFs to examine MTFs' leadership training journey and the demonstration of their evolving leadership skills in the course of their own implementation of teacher-driven professional development activities to other teachers (i.e., epitomizing how a high school science teacher helps other teachers to improve science teaching in the light of their own evolving professional vision, identity and leadership skills).

There is a little empirical research examining teacher leadership that considers the impact of professional vision and identity on leadership performance. Thus, this study focused on how MTFs' perceptions of their teacher leadership roles and characteristics and professional vision and professional identity changed over time across the I-LEAD professional development leadership program and as they developed, facilitated, and completed teacher-driven professional development for K-12 teachers. Thus, associatively, this study illustrated how evolving

professional identities and professional vision of a group of MTFs relate into demonstration of leadership skills via TDPD activities.

Context of the Study

I conducted this research study with evolving teacher leaders, MTFs, who participated in the I-LEAD research project. The I-LEAD project, at a university in Southeastern US, was fundamentally designed to recruit experienced secondary science teachers, Master Teaching Fellows (MTFs), and give them the skill set necessary to improve the quality of STEM education and to be agents of change locally, regionally, and nationally. The I-LEAD project supported MTFs in a progression towards teacher leadership. The focus of this teacher leader education program, I-LEAD, was to: (a) enhance pedagogical content knowledge considered as an integral part of the participants' experiences; and (b) develop a highly evolved professional vision in these individuals to be capable of enabling others (e.g., fellow/other teachers, administrators) to become change agents within the educational system. Further, it allowed individuals to better anticipate obstacles to the realization of a change in the system as well as to formulate plans for overcoming those obstacles.

The project team adopted a conceptual framework for that aspect of the project, which merged Goodwin's (1994) notion of professional vision with Dempsey's (1992) four metaphors (*teacher as fully functioning person, teacher as reflective practitioner, teacher as scholar, and teacher as partner in learning*) for describing the nature of a teacher leader. With this design, the I-LEAD project team delivered professional development sessions once a month since early 2011. Targeted MTF activities are were follows: In year one, developing classroom leadership and mentoring (teacher as reflective practitioner); in year two, mentoring teacher fellows (teacher as reflective practitioner); in year three, emerging local leader (teacher as reflective

practitioner and scholar); and in year four and five, emerging state, regional and national leader (teacher as scholar and partner in learning). At the end of the project, the project aims to serve as a national model for others with similar institutional goals. Relative to the current study, one of the I-LEAD project's targets was to have MTFs demonstrate their evolving leadership skills either at their own schools or at other schools in their school district (i.e., outreach activities for other teachers).

With respect to this purpose, MTFs delivered professional development for diverse groups of teachers in their counties through Math and Science Partnership (MSP) programs. The MSP program strived to improve teacher quality through partnerships between state education agencies, institutions of higher education, high-need local education agencies, and schools to increase the academic achievement of 3rd through 12th grade students in mathematics and science. This program supported the partnerships of at least one Southern State's high-need school district or consortium (such as a RESA), at least one institution of higher education department of science, mathematics, and/or engineering, and at least one institution of higher education's department of teacher preparation. The funding was used to provide professional learning for mathematics and science teachers. However, the current study does not focus on evaluating the outcomes of PD programs of either I-LEAD or MSP projects, but focus on MTFs' leadership trajectory while training by I-LEAD and delivering teacher-driven professional developments via the MSP program.

Purpose of the Study

The purpose of this study was to examine MTFs' perceptions of their leadership roles and capabilities and their professional vision and identity as they participate in the I-LEAD

leadership development-training program and facilitate PDs for K-12 teachers. Thus, specifically, this study asked following questions:

Research Questions

1. How do Master Teacher Fellows' (MTFs') perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development opportunities as they evolve from teachers into teacher leaders?
    a. How do MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through their participation in an I-LEAD professional development leadership program?
    b. How do MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development activities as they develop, facilitate, and complete Teacher-Driven Professional Development for K-12 teachers?
    c. In what ways do MTFs perceive their professional vision, professional identity, and teacher leadership roles affect one another through their own leadership trajectories?

Theoretical Framework

In the existing literature, several theoretical perspectives are used to examine teacher leadership and its development at the individual and/or organizational levels (DuReu & Myers, 2014; Marks & Printy, 2003; Marsh, 2000; Tng, 2009). Their theoretical stance allows researchers to ground meaning construction more accurately within the specialized focus of their inquiries. Following this practice, this study relied on Symbolic Interactionism as the theoretical foundation for how people make meaning in the social world, and for understanding their perceptions on their practice of teacher leadership. In the following section, I explain this

theoretical framework and why this theory best explains what affects the master teaching fellows' (MTFs') perceptions on their leadership trajectory from the level of the individual MTFs to the level of the professional learning communities (PLCs) in which they work.

Symbolic Interactionism.

Symbolic Interactionism (SI) is a sociological theory developed by American philosopher George Herbert Mead and publicized and interpreted after his death by his student Herbert Blumer (Teo & Osborne, 2012). This theory explains that humans act based on the meaning that interactions have for them, developed from experience (Blumer, 1969; Denzin, 1992; Mead, 1934). According to Blumer (1969), the three basic interactionist principles are:

- that human beings act toward things on the basis of the meanings that these things have for them;
- that the meaning of such things is derived from, and arises out of, the social interaction that one has with one's fellows;
- that these meanings are handled in, and modified through, an interpretive process used by the person in dealing with the things he encounters. (p. 272)

Besides Blumer's three principles as cornerstones of interactionist perspective, some other assumptions explicitly provide philosophical foundations under the guide of Blumer's perspective. Strauss (1993), for instance, explained that human beings have the ability to use symbols to think, make plans, improve a sense of self, participate in complex forms of relationships and communications, and take the roles of other. Sandstrom, Martin and Fine (2003) extend Blumer's vision as to how interpretation and modification of the meanings produce a behavior/action. "Our behavior… is built up and constructed, based on which stimuli and objects we take into account and how we define them" (p. 218). The underlying point here is

self-interaction, which promotes self-reflective thinking after experiencing a variety of social factors, like class, gender, occupation that constrain one's own thoughts (or behaviors, or attitudes).

SI emphasizes the significance of individuals' symbolic capabilities that individuals use and build on symbols to give meaning to people, their behavior, or the occurrences rather than directly to their responses. In essence, individuals learn the meaning of mechanisms through the agency of interaction with one another to symbolically interpreted realities, which are socially constructed (Crotty, 1998; Sandstrom et al., 2003; Hewitt, 2000). Crotty stresses *that* meaning is created from social interactions, which derives from human response or actions. That is, people seek to understand the relationship between self and society through social interaction and symbolic understanding only through associating with others. In the process of attaining various behaviors, as Strauss (1993) asserts, individuals become capable of using symbols to think, make plans, improve perceptions, assume roles of others as well, and take part in a wide variety of multifaceted systems of communications and social organizations. Thus, an individual vigorously embodies his perceptions, behaviors, and identities and as Charon (2007) states, perceives social reality based on the self-interpretation.

The basic fundamental perspectives and postulates of SI demonstrate there is a parallel line between symbolic interactionism and teacher leadership developmental phases, such as the importance of relationships and communication to strengthen teachers' leadership skills. In SI, "symbols are socially created and used to represent shared meanings among members of societies and/or cultural groups. As such, they are used to communicate, are intentional and meaningful" (Burbank & Martins, 2009, p.29). Regarding the teacher leadership literature, group interactions and collaboration provide positive learning environments for the teacher leaders to

bring out and fulfill their strengths, capacity and abilities (Gabriel, 2005). As Murphy (2005) states, the heart of teacher leadership is "interactive in design and relational in form" (Murphy, 2005, p. 31). Different levels of knowledge and perceptions can be constructed with different human interactions in diverse social environments (Burr, 2003; Sandstorm et al., 2003).

Social interactions also help leaders to better understand their own potential, behaviors and self-awareness; thus leaders develop major awareness of how to put their leadership knowledge and skills into practice as they make sense of their own and others' behaviors. That is, teacher leaders interact through symbols (e.g., their own or others' dialogs, roles, attitudes, behaviors, actions, situations, etc.) and then develop a concept of larger social structures and also self-concepts (i.e., professional vision and identity). In this self-reflexive meaning making process, teacher leaders' self-awareness is critical in having appropriate meanings and reflecting these meanings in their leadership behaviors. Thus, human action is caused by interaction among individuals, as well as by interaction within the individual. As Blumer (1969) claimed, "The possession of a self provides the human being with a mechanism of self-interaction with which to meet the world – a mechanism that is used in forming and guiding his [or her] conduct" (p. 535). In that aspect, teacher leaders' self-reflections (i.e., reflection narratives) helped me to understand each MTF's interaction both with others and within themselves regarding their sense of evolving leadership.

In that sense, professional learning environments (e.g., PD milieus) are social environments where teachers professionally interact with each other, and are fruitful areas for meaning making through interactions. Recently, there has been a rise in the realization that leadership development with identity formation must also embrace the roles of common relationships in social venues (Carrol & Levy, 2010). Leadership development considers the

development of social formations that includes a process of understanding how to influence and how to be influenced. In this process, interpersonal relationships, social influences, and team dynamics between the leader and others play a great role in carrying out effective social networking and development processes (Moyer-Packenha, Bolyard & Oh, 2006; Rhoton & McLean, 2008; Taylor, Goeke, Klein, Onore & Geist, 2011). This idea supports how symbolic meanings evolve in this network of relationships. In other words, meaning making was socially oriented and all actors in the professional learning communities (i.e., I-LEAD PDs and TDPDs) had significant influence on MTFs' transformational meaning making and interpretations. Precisely on this point, Teo and Osborne (2012) enlighten the current research study:

> People meet in different situations to indicate lines of actions to others and interpret other's lines of action—the process sustains, undermines, modifies, and transforms these lines—hence, social interaction is observed empirically. The society is a collective unit consisting of arrangements of people performing social actions at their respective positions in the larger organization and their actions combine to form the larger organization of actions. (p. 547)

Thus, the interpretation of MTF's self-perceptions through the lens of SI was useful in uncovering the meaning of various aspects of the I-LEAD program in developing their professional vision, professional identity, and leadership roles and characteristics. As the literature illustrates, a Symbolic Interactionist theoretical stance helps in understanding that leadership is only a slice of the interactive process of sense making and meaning-making manufactured from the influences of social and organizational milieus (i.e., PD and TDPD). SI comprehensively served this study's purpose and led me to understand the MTFs' leadership progress from their perceptions regarding their strengths, weaknesses, others' thoughts, and

influences of their beliefs, values, professional identities, and visions to their leadership trajectory. Thus, in this way, the MTFs might make a difference on their leadership roles, professional vision and identity, or lead change in their schools.

Significance/Rationale of the Study

Teacher leadership has received intense interest as an area of educational research over the past three decades (Crowther et al., 2002; Harris, 2003; Lambert, 2002; Marks & Printy, 2003). Most of this research has focused on the qualifications, impacts, and development of teacher leadership (Smylie & Mayrowetz, 2009). Much research on PD in education has been concerned with teacher's professional quality and competence in a rapidly growing world (Greenleaf, Schoenbach, Cziko, & Mueller, 2001; Grossman, Wineburg, & Woolworth, 2001; Loucks-Horsley, et al., 2010). In educational settings, new teaching and learning practices, and the importance of teacher leadership skills become more significant.

The focus of research has been mostly on formal teacher leadership roles (e.g., department chair or team leader); however, there is a gap in the literature investigating outcomes during teacher leaders' evolving process and how these leaders can contribute to their own leadership development as contributing others' professional learning by their own actions and/or designs of PDs for other teachers. Thus, in this process, teachers nurtured each other's practices, and revised their professional visions and identities as a framework for improved professional performances (i.e., as developing leadership skills of MTFs and enriching science teaching practices of K-12 teachers).

This study aimed to broaden the scope of research including teachers' engagement in leadership practices and considering professional vision and identity rather than focusing only on formal and informal leadership roles. This study developed a conceptual framework for

understanding how teacher leaders' professional vision and identity and teacher leadership roles affect one another across the leadership development process. In addition, while many studies have examined PD in a regular sense, there seems to be no study that has examined the effect of TDPD for teachers who are in need of instructional science knowledge on developing and demonstrating leadership skills in experienced teachers (i.e., MTFs). This gap in the literature was narrowed by this study. Thus, this study enriched the understanding of the role of professional development and teacher-driven professional development in enhancing teacher leaders' evolution of teacher leadership, professional vision, and professional identity while boosting professional practices (e.g., teaching and learning strategies) of K-12 colleagues.

2 REVIEW OF THE LITERATURE

Leadership is defined as "the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives" (Yukl, 2010, p. 8). Leadership is a behavior that guides actions of a group to accomplish shared goals or powerful reinforcement throughout the organization (Katz & Kahn, 1978). When speaking of leadership in education, the first thing that comes to mind is the position of school principals and/or other senior level administrators. This is discouraging when literature shows that educational leadership is not limited to only principals and other educational administrators (Lieberman, 1995; Pugalee, Frykholm, & Shaka, 2001; York-Barr & Duke, 2004). Educational leadership is also the domain of teachers.

Educational/school leadership is the process of establishing and guiding the capacities and dynamisms of teachers, students, and parents toward achieving shared and certain educational targets (Donaldson, 2006; Marzano, Waters & McNulty, 2005). Leaders are responsible for establishing and developing visions, targets, commitments, moral purposes, values, and strategies in order to guide and monitor desired action and behavior for school achievement. To achieve effective teaching and learning environments while sustaining change, the role of the principal is central. School leaders have a critical role not only in helping new and veteran teachers to meet group goals and share experiences but also in supporting teachers' continuous professional growth. Fullan (1994) proposes a framework that embraces five core components of leadership: moral purpose, understanding change, relationship building, knowledge creation and sharing, and coherence making. In her book, Lambert (2003), outlines the five major prerequisites for high leadership capacity to enable educators to more fully implement their leadership knowledge in schools and districts: (a) skillful participation in the

work of leadership, (b) inquiry-based use of data to inform decisions and practices, (c) broad involvement and collective responsibility for student learning, (d) reflective practice that leads to innovation, and (e) steadily improving student achievement.

In schools, leadership is not the sole responsibility of the principal; it is also a responsibility of assistant principals, department heads, teacher leaders, and other members of the school's improvement team (Crowther et al., 2002; Fullan, 1994; York-Barr & Duke, 2004). That is, leadership within a school is a collaboration between administrators and teacher leaders. This means that teachers' roles are critical in the leadership and management of schools.

The following review of the literature explores both empirical studies and conceptual or pedagogical articles related to the construct of teacher leadership and the development of leadership skills in numerous fields and at various school levels, including the relationship between mentoring and teacher leadership. I conclude with a definition of teacher leadership that guides the proposed research.

Teacher Leadership

Through the 1990s, the focus on teacher professionalism called attention to the role of teacher leaders as well as other sources of leadership in schools (Crowther, Ferguson & Hann, 2002; Harris, 2003; Lambert, 2002; Marks & Printy, 2003). If educational leadership within schools is a product of collaboration among principals, other stakeholders, teachers, teacher leaders, who have characteristics of leadership and a closer connection to the administration of school, provide a worthwhile contribution to school's teaching and learning environment. Thus, it seems reasonable that teacher leadership is an essential component for educational improvement, in spreading and reinforcing school reform efforts. In the broadest sense, teacher leaders are both teachers and leaders. Thus, in the most basic way, *teacher leader* is defined as a

professional who leads his or her own classroom in a successful way and has influence outside of classroom. A large body of literature related to clarifying "who are teacher leaders?" indicates that teacher leaders have substantial teaching experience, and the potential to be followed and respected by their colleagues and they hold the capacity to influence their colleagues' practices (York-Barr & Duke, 2004).

Historically, much of the teacher leadership literature is theoretical in nature rather than including actual classrooms and practice (Barth, 2001; Fullan, 2002; York-Barr & Duke, 2004). The teacher leadership literature has also studied teacher professionalization (Firestone & Bader, 1992). Livingston (1992) clarified that teachers are better able to maintain dynamism for sustainable changes in a wide-ranging way since they are in the most appropriate position as they have regular interaction with learners to make critical decisions about curriculum and instruction. Correspondingly, according to Katzenmeyer and Moller (2001), teacher leaders' roles do not only comprise classroom efforts but also contribute to a community of teachers' and leaders' efforts to continuously provide improved educational practices. Can (2009) defines teacher leadership as taking over voluntary responsibilities during the educational processes and activities, establishing independent projects, inspiring colleagues, and having the competence to develop professional learning communities to effectively carry out requirements of the school system. Thus, the contribution of teacher leadership to the school involves increasing responsibilities of teachers beyond the classroom, referenced as *moving out of ones' comfort zone* (Ryder, 2013).

Regarding roles and responsibilities of teacher leaders, some other studies also underline specific leadership expertise. For example, strong teaching and learning abilities are defined as one characteristic of teacher leaders' expertise (Yow, 2010). That means, "individuals who

function as teacher leaders are reported to have a solid foundation of teaching experience and expertise." (York-Barr & Duke, 2004, p. 267). Snell and Swanson (2000) studied 10 classroom teacher leaders over two years to discover what experiences contribute to the development of teacher leaders. They found that expertise is the foundational dimension, in that it establishes credibility. The authors also emphasize the importance of informal leadership roles in which teachers demonstrate high levels of instructional expertise, collaboration, reflection, and a sense of empowerment, as ways to becoming teacher leaders. Lieberman, Saxl, and Miles (1988), after studying seventeen teacher leaders over two years, described their proficiencies as organizational judgment, providing guidance for finding and implementing resources, adaptation to the developmental process, dealing with leadership responsibilities, and creating confident and positive learning environments for both teachers and students. The results also show that these teachers were aware that they increased the ability to promote learning among their colleagues. In that sense, leadership creates a space for both teacher leaders and other teachers to display their professional potential.

Roles and Impacts of Teacher Leadership.

Literature on teacher leadership also reveals some limited assumptions about roles of teacher leadership, such as (a) "beyond the walls of the classroom teacher leadership roles have been limited in scope" (Livingston, 1992, p. 9); and (b) teachers have "limited formal leadership roles in schools and school districts" (Smylie & Brownlee-Conyers, 1992, p. 150). Kelley (2011) purports "teacher leadership is a broad term used in a variety of ways to describe teachers in a leadership role, whether formal or informal" (p. 4). Gabriel (2005) states, "Not all leadership positions are formal in nature. Every school has teacher leaders who do not serve- and may never have served-as official leaders" (p. 3). Gabriel highlights the most prominent role of teacher

leaders as "the supporters whom the leader can trust and turn to for help in a variety of matters" (p. 4). Gabriel further categorizes twenty specific teacher leadership roles to illustrate possible roles for teachers who can take either formal or informal leadership position. The most representative roles among those roles are as follows:

- *Grade Level/Subject Area Leader* (e.g., coordinating particular organizational needs, and running meetings);
- *Mentor* (e.g., coaching and advising novice teachers);
- *Peer Coach* (e.g., functioning as mentor and mentee without judgment);
- *Presenter* (e.g., presenting both the school outside, and reporting back to the team;
- *Conference Attendee* (e.g., attending to professional meetings and bringing information back to the group);
- *Faculty Representative* (e.g., bringing the issues to the council);
- *Host Teacher* (e.g., assisting unit and lesson plans, and allowing student teachers for teaching practice, and giving feedback);
- *Community Leader* (e.g., hosting national exams, informing parents);
- *Supplies Coordinator* (e.g., ordering lab equipment, books, and other required sources).

Assuming these roles may inspire informal teacher leadership and groom aspiring leaders, thereby promoting effective instructional practices and increased school's achievement. Additionally, Kelley (2011) focuses on formal teacher leadership as a "formal role within a specific committee, as either a member or a chair, whose charge is directly related to student achievement and school improvement" (p. 6). In his qualitative study, Kelley investigates teachers' and teacher leaders' beliefs concerning the formal role of teacher leadership. Analysis

of the data collected throughout the study suggests that there exists a disconnect between teachers' and teacher leaders' beliefs of what formal teacher leadership should ideally look like in their schools. This study's results suggest teachers may prefer to be on an equal level with their colleagues; and desire a stronger presence of collaboration and an understanding of a more formal position. Therefore, this result reveal the understanding of what new roles become determinative factor for teacher leaders in terms of shaping and reshaping their meaning of teacher leadership thereby their professional vision and identity. However, it is worth stating here that teacher leaders in the study assert their discomforts about being obligated to completing administrative tasks rather than working with their colleagues, which they believe more directly influences school improvement efforts (Kelley, 2011).

As is often noted in the literature, teacher leaders also share responsibilities with administrators, such as being involved in organizational regulations, the decision-making process, cultivating rapport, skills, trust and confidence among colleagues, dealing with obstacles, and managing the process to carry out school success into higher levels (Ackerman & Makenzie, 2006; Kelley, 2011; Lieberman et al., 1988; York-Barr & Duke, 2004). Further, if teachers have been in several leadership roles, such as grade/department chairs, team leaders, and curriculum developers (Silva, Gimbert, & Nolan, 2000), their impact can affect students, other teachers, schools, districts, and even state policies (Gess-Newsome & Austin, 2010; York-Barr & Duke, 2004). DeHart (2011) outlines the effects of teacher leadership as having an impact on: (a) themselves (e.g., improving self-esteem, morale, motivation, leadership skills, pedagogical knowledge, instructional practices, self-efficacy, etc.); (b) their colleagues (via support with disruptive students, instructional practices, and dealing with resistance to change); (c) their schools (including improving effectiveness of implementation of new policies, procedures, and

school reform); and d) students (by increasing their engagement and achievement in school). Roby (2011) found that elementary, middle, and high school teacher leaders had a positive impact on school culture, creating fruitful learning environments and continuous learning for other teachers and the school system.

Most of teacher leadership literature as cited above also illustrates that teacher leadership roles, skills, or positions (i.e., formal or informal) do not differ by teachers' grade level or subject area. Considering both formal and informal leadership, Stone, Horejs and Lomas (1997) found no differences in teacher leadership practices at the elementary, middle, and high school levels. In this study, both qualitative and quantitative approaches were used with multiple data sources (e.g., interviews with their colleagues and principals, observations, staff surveys, etc.). The authors concluded that teacher leaders undertake leadership roles to: (a) accomplish meaningful work, (b) understand more fully the educational enterprise, (c) increase overall knowledge and skills, and d) expand influence and participation in decision-making processes. The most common challenges different grade-level teacher leaders experienced were: a) restrictions caused by time, power, and politics and (b) the hierarchical structures in which teacher leaders were viewed by colleagues as both leaders and peers. Teacher leaders can improve professional practice and school efforts by inspiring collaboration, decision-making and raising teacher's voices. As can be understood by this study and other studies in teacher leadership literature, teacher leadership is a process of ongoing commitment to improving teaching profession and increasing school achievement no matter what grade levels of the teacher leaders.

Definitions/Characteristics of Teacher Leadership.

In addition to the roles and impacts of teacher leadership, teacher leadership has also

been described by educational theorists (e.g., Goldberg, 2001; Harrison & Killion, 2007). In the literature, theories of educational leadership embrace teachers as a constituent of leadership in different fashions. Several theories have been commonly studied and adopted with distinctive foci and dimensions to identify teacher leadership and its progress at either/both individual and organizational levels. Besides theorists, a number of researchers have provided definitions of teacher leadership that obviously present their diverse perspectives. Table 1 presented below shows the definitions of teacher leadership that are have been used in various research studies.

Table 1

Definitions/Characteristics of Teacher Leadership

Author(s)	Definition of Teacher Leadership (is):
Youitt (2007)	teachers who "lead learning by embracing new methods of teaching and learning. They understand the importance of the relationship between teachers and students (and their families). These teachers also frequently engage the use of new technologies in their teaching, and understand the need for resourcing flexibility to support educational innovation" (p. 1).
York-Barr & Duke (2004)	"the process by which teachers, individually or collectively, influence their colleagues, principals, and other members of school communities to improve teaching and learning practices with the aim of increased student learning and achievement" (p. 287-288).
Crowther et al. (2002)	the "facilitation of principled action to achieve success for the school by applying teaching to shape students' perception and enhance their community life for the long term" (p. 10)
Childs-Bowen, Moller & Scrivner (2000)	the "function in professional learning communities to affect student learning; contribute to school improvement; inspire excellence in practice; and empower stakeholders to participate in educational improvement" (p. 28).
Miller, Moon, & Elko (2000)	"refers to actions by teachers outside their own classrooms which involve an explicit or implicit responsibility to provide professional development to their colleagues, to influence their communities' or districts' policies, or to act as adjunct district staff to support changes in classroom practices among teachers." (p. 4)

Clemson-Ingram & Fessler (1997)	"refers to a variety of roles for classroom teachers in staff development, management, and school improvement" (p. 95).
Crowther (1997)	"manifests in actions that involve the wider community and leads to the creation of new forms of understanding that will enhance the quality of life of the community in the long term. It reaches its potential in contexts where system and school structures are facilitative and supportive" (p. 15).
Fullan & Hargreaves (1996)	"the capacity and commitment to contribute beyond one's classroom" (p. 13).
Katzenmeyer & Moller (1996)	"teachers are leaders when they are contributing to school reform or student learning (within or beyond the classroom), influencing others to improve their professional practice, or identifying with and contributing to a community of leaders" (p. 5).
Crowther & Olsen (1996)	"an ethical stance that is based upon the views of a better world and the power of teaching to shape meaningful systems. It manifests itself in actions that involve the wider school community and leads to the creation of ideas that will enhance the quality of life of the community in the long term" (p. 32).
Darling-Hammond, Bullmaster & Cobb (1995)	"inextricably connected to teacher learning... in the course of restructuring opportunities to collaborate and take initiative are available at every turn. The specific teacher leadership responsibilities that evolve are not a predetermined priori idiosyncratic but are varied, flexible, and to individual school teams and their distinctive situations" (p.89).
Lieberman et al. (1988)	"not only making learning possible for others but, in important ways, are learning a great deal themselves. Stepping out of the confines of the classroom forces these teacher-leaders to forge a new identity in the school, think differently about their colleagues, change their style of work in a school, and find new ways to organize staff participation" (p. 164).

The notion of teacher leadership has become a worldwide phenomenon of interest to both researchers and practitioners, notably in the U.S. The importance of teacher leadership in the US recently is to cultivate teacher leadership in school reform initiatives (Smylie, 1995). So, to go around teacher leadership comprehensively, understanding of what components of TL must be considered is key. In a general perspective, and in the light of majority of the literature associated to teacher leadership, teacher leaders are both teacher and leaders who have significant teaching

experience and expertise as prior condition. To be more precise and connected to purpose of this study, specific definition of teacher leadership, which shows ideal teacher leadership characteristics, helped in addressing the research questions.

Synthesis of the Notion of Teacher Leadership.

According to York-Barr and Duke (2004), "Very few authors provide what would be considered a definition of teacher leadership. The lack of definition may be due, in part, to the expansive territory encompassed under the umbrella term teacher leadership" (p. 260). Within the range of other studies, adhering to the existing particular definition(s) can bring about inaccurate interpretations of results or a narrower or broader focus on teacher leadership. Thus, pulling together the essential aspects of the entire literature on teacher leadership gave me the features that comprise the conceptual framework of teacher leadership. In this study, I suggest an overarching definition of teacher leadership that includes the following leadership characteristics:

The Definition Used in this Study: Teacher leadership is the process utilized by teachers who have adequate experience in teaching, and appropriate skills to: (a) revise and/or renew their self-awareness of their professional visions and identities (e.g., values, beliefs, knowledge, needs, plans, potentials, and experiences) in a self-reflective and self-regulative manner, (b) monitor and transfer new educational reforms/ideas for sustainable implementation to improve teaching practices for both their own, and followers/colleagues, (c) inspire colleagues to take responsibilities in various aspects of the school, especially in teaching and learning, (d) deal with current, or possible obstacles/barriers with colleagues, (e) facilitate and nurture positive relationships, team culture, and teaching and learning activities (e.g., building trust, effective communication and problem/conflict solving strategies, and positive work environment), and (f)

employ transparent decision-making and implement decisions in the interest of entire community's/school's vision and mission.

Role of Mentoring in Teacher Leadership.

In general, the word *mentoring* is used to refer to a developmental partnership where an experienced person takes responsibility in fostering the personal and professional growth of someone who is novice (Mayo, 2002; Rogers, 2006). Yet, this concept of mentoring is used differently in different fields, and it is open to a range of interpretations (McGowan, Saintas, & Gill, 2009). In business, for example, it is considered as a formal process within an organization that promotes the development of the protégé while benefiting the organization (Ensher & Murphy, 2006). In the field of education, the concept of mentoring is perceived as a helpful role with a set of functions within an educational context whereby learning is augmented by the introduction of a supportive element into the learning enterprise (Shulman & Sato, 2006**).** A mentoring experience may include broad forms of support consisting of professional assistance, career development, and role modeling (Brown & Davis & McClendon, 1999) for new teachers and/or student teachers.

The four main roles of mentoring as defined by Jonson (2002) are: career management for both mentor and mentee, self-reliance, support, and helping the mentees gain the knowledge, skills and understanding they need by sharing experiences. In working towards these goals, mentors will assume a number of different roles. The most commonly performed of these are coach, counselor, networker, facilitator, critical friend, sounding board, and role model. The ways in which mentors help mentees to achieve their specific goals requires them to have a range of different strategies at their disposal. The need to adapt help to meet the needs of mentees present at any given time is an additional role of the mentor. This flexibility and responsiveness

underpins the more specific behavioral sets (i.e., interpersonal skills) that are desirable in mentors (Jonson, 2002).

Interpersonal skills for science education mentors must require the following, as mentioned by Jonson (2002): (a) building collegiality with beginning science teachers; (b) establishing good working relationships, (c) creating partnership with parents through communication and conferencing, (d) working on school improvement without becoming overwhelmed, and (e) understanding and carrying out the school philosophy. Jason's (2002) study highlighted significant functional roles regarding interpersonal skills of mentors but did not address the area of mentors as teacher leaders. In the current study, the teacher leaders, MTFs, are also mentor teachers (mentor leaders) at their schools. Thus, this proposed study would address whether MTFs, as mentor leaders, transfer their mentoring skills into other leadership practices, such as conducting professional development for teachers who come from different schools.

From another angle, despite the fact that mentor teachers participate in reform-based professional development programs (NRC, 1996, 2000), some studies have shown that they continue with conventional norms and practices (e.g., Crawford, 2007; Feiman-Nemser, Parker, & Zeichner, l993). Crawford's (2007) study is a good example of the reform-based efforts failing to produce reform-minded mentors. Yendol-Hoppey and Dana (2007) define reform-minded "as a progressive stance toward teaching that acknowledges the importance of research-based practices, problematizing teaching and learning, and embracing change with the aim of educating all children" (p. 6). Crawford (2007) examined the knowledge, beliefs, and efforts of five prospective teachers to enact teaching science over the course of a one-year high school fieldwork experience. Additionally, Crawford investigated how mentor teachers' views of

teaching science appear to support or constrain prospective teachers' intentions and abilities to teach science. The participants, mentor teachers, who participated in this study, had taken a college course, *Teaching Science as Inquiry*, taught by Crawford during the previous year. Crawford reported that although all participants began the school year with enthusiasm and appeared to design inquiry-based lessons, this enthusiasm began to wane and, in some cases, eventually disappeared. Crawford expounded on the findings and stated, "The mentor teachers' beliefs and preferred pedagogical approaches appeared to deter at least some of the prospective teachers from deviating from the Mentor's established classroom culture" (p. 623).

At the elementary level, Hudson (2003) argues that mentors require pedagogical knowledge of primary science for guiding mentees with planning, timetabling, preparation, implementation, classroom management strategies, teaching strategies, science teaching knowledge, questioning skills, problem-solving strategies, assessment techniques, and developing viewpoints on science pedagogy. The key study findings indicate that 55% or more mentees had not received pedagogical knowledge for primary science teaching while receiving mentoring. This paper brought to a conclusion that mentors require further professional development to improve teaching primary science. To address this need in the literature, this study looks to bridge this gap in the science field, and emphasize possible further roles of mentor leaders gained by professional development.

Mentor roles are complex since induction programs are collaboration between administrators, stakeholders in policymaking, and mentor teachers (Joerger & Bremer, 2001). Mentor teachers are expected to communicate with school leaders, teacher leaders, colleagues, and new teachers to offer new knowledge (e.g., reform-based) and skills to move novice teachers to a better level of teaching and learning practices. Thus, mentors need additional support to be

capable of being effective mentors and to cope with the complexity of their mentor roles (Little, 1990). Little's guide for effective mentor training called attention to the importance of school leaders. In this guide, Little focused on six specific areas: (a) alignment of mentoring roles, (b) assisting new teachers, (c) classroom management for new teachers, (d) consultation, observation and coaching for classroom practices, (e) working with colleagues, and (f) cooperation between administrators and mentors. This guide also illustrates the close connection between ideal mentor roles and teacher leader roles. Further, the training guide in Little's study emphasized that PDs provide an awareness of mentor teachers' leadership roles as a change mechanism for the understanding of reconsidering leadership style to meet the needs of new teachers.

Many researchers have conducted studies on teacher leaders' roles in collaboration and mentoring (Ackerman & Mackenzie, 2006; Conley & Muncey, 1999; Mayo, 2002; Rogers, 2006). In literature, mentoring is described as one of the formal roles of teacher leadership in terms of supporting one another and helping each other transform their practices (Ackerman & Mackenzie, 2006; Dozier, 2007; Gabriel, 2005; Swanson, 2000). Dozier's (2007) study, for instance, surveyed 300 proficient teachers and found that the teachers' leadership activities embrace being involved in the school as department chairs, grade chairs, and mentors to other teachers. To grow professionally, mentoring is also seen as a vital step in contributing to school endeavors (Smylie, Conley, & Marks, 2002). Kelley (2011) states, "Without mentoring and collaboration, many teachers would leave the field long before they were ready to take on teacher leadership roles, ending the reciprocity that renews the role" (p. 37). In that sense, mentoring, like other teacher leadership roles, nurtures teachers' leadership skills such as on guiding, encouraging for networking and growing.

In brief, mentoring is seen as being the strongest role in influencing and supporting

colleagues' personal and professional growth. Mentoring can be a good starting point in terms of practicing leadership characteristics as a baseline for other teacher leadership activities. Mentoring creates a space for teachers to display their leadership potential as it indirectly brings value to the school community. Thus, mentoring is an essential leadership role in managing and inspiring colleagues. It is also important that mentors help others to learn and grow so both mentors (as teacher leaders) and mentees become more effective in their own profession. As Suranna and Moss (2000) claim, "The aspect of teacher leadership most identified was serving as mentor and role model for the development of new teachers. Many participants spoke of being mentored by teacher leaders who modeled exemplary practice" (p. 8). Thus, mentors can develop their leadership expertise in the course of mentoring practices and partnerships; mentoring as a subset of teacher leadership can be a rewarding experience both personally and professionally. When mentors advance their leadership skills by training, they become able to nurture their own leadership skills as well as help others' (i.e., students' and other colleagues' as well as novice/student teachers') learning, including strengthening their communication skills, ways of thinking on teaching, reform-based teaching and learning practices, career, contribution to school management system, and how to gain a great sense of personal and professional satisfaction.

However, teacher leaders', including mentors', growth takes place during their career. Teachers who have not been educated about out of classroom activities need to learn how to practice leadership responsibilities while in the profession. As York-Barr and Duke (2004) argue that leadership characteristics and professional practices of teacher leaders mature during their involvement in the leadership process. With respect to this idea, teacher leaders, who have a mentor leadership role and/or any other leadership roles, play a critical role in collaboration with other teachers and administrators and should be provided professional development (PD) to fully

understand the leadership process (Ackerman & Mackenzie, 2006; Beatty, 1999; Mayo, 2002; Rogers, 2006). That is, without any professional support, teachers might not successfully fulfill the responsibilities and requirements of these roles of mentor leader and/or teacher leader.

Professional Vision

In 1994, Goodwin coined the term *professional vision* to characterize the specialized way that members of a professional group look at the phenomena of interest. In the era of education, specifically in the teaching profession, Goodwin's (1994) concept of professional vision has served as base for a variety of definitions. Numerous authors portray the professional vision of teacher leadership on the basis of *design of action*, and/or *practices in the profession* (e.g., Beachum & Dentith, 2004; Danielson, 2007). According to Blomberg, Stürmer, and Seidel (2011) "teachers' professional vision is their ability to observe what is happening in a classroom and to make sense of it from a professional perspective" (p. 1131). Similarly, professional vision is explained as the ability to notice and make sense of important characteristics of classroom interactions by teacher education researchers (Blomberg et al., 2011; Sherin, 2001; Sherin & van Es, 2009).

Sherin, Russ, Sherin, and Colestok (2008) described professional vision in a particular fashion, "The application of professional vision (PV) happens in a manner that is fleeting, and that is distributed through the moments of instruction" (p. 28) and *sort of noticing* (p. 43). In their study, the authors examined teachers' PV from short excerpts of videos that were derived from their own teaching, or the teachers' discussion of explanations, practices, reflections and their reasons for selecting clips. The results demonstrated teachers' professional vision is concerned with the phenomena of classroom interactions, and involves the ability to notice and interpret significant interactions in a classroom. Blomberg et al. (2011), describing teachers'

professional vision as, "[Teachers'] ability to observe what is happening in a classroom and to make sense of it from a professional perspective" (p. 1131), investigated the professional vision of 32 pre-service teachers' (majoring in mathematics and science) elicited from videos of various subjects. Participants were administered rating items targeting their PV since using video as prompts is seen as a key approach in assessing PV (Blomberg et al., 2011; Kersting, 2008; Santagata, 2009). Blomberg et al. found different PVs among pre-service teachers, derived from distinct sets of shared beliefs and values.

It is not surprising that teachers' professional vision has typically been seen as a generic ability (pedagogical aspects of instruction) applicable across teaching subjects, e.g., mathematics, science, and reading (Blomberg et al., 2011; Sherin, 2002; Sherin et al., 2008). However, PV goes beyond knowledge attainment of subject-specific socializations due to diverse beliefs, values and background knowledge of teaching subject. Blomberg et al. (2011) assert that the notion of professional vision provides a means to study the development of teacher expertise. Thus, they believe that "understanding the processes involved in developing professional vision, which is by consensus an important part of teacher expertise, can help us make progress in knowing how to best support pre-service teachers in becoming a successful teacher" (p. 1139). Thus, developing the process of teacher practices requires professional support for sustainability and the expandability of the notion of professional vision.

Styhre (2010) asserts, "professional vision is something that needs to be trained and 'calibrated' against the vision of the other professional members of a community" (p. 450). Styhre believes that the need for professional support is that one of the most challenging aspects of an individuals' profession in terms of pushing existing beliefs or previous experiences even though they are being capable of observing and internalizing multiple specific things in their

workplace environment. In that sense, it is important to note here that professional vision should not be thought only as a cognitive ability (Lefstein & Snell, 2011). According to Lefstein and Snell (2011) professional vision also has a social side, since social practices of seeing what is happening involve social skills to notice and perform appropriately.

Various recent studies have explored how to nurture the development of professional vision and how to assess it (Blomberg et al., 2011; Borko, Jacobs, Eiteljorg, & Pittman, 2008; Kersting, 2008; Santagata, 2009; Sherin & van Es, 2009; van Es & Sherin, 2008). In particular, according to these authors, videos are most commonly used to understand and reveal teachers' PV. Reactions to videos that capture the complexity of particular situations/environments are believed to be good indicators for understanding and assessing PVs.

"The concept of PV has been influential in education research as a key frame for thinking about the design and study of video-based teacher professional development" (Lefstein & Snell, 2011, p. 506- 507). The authors found that PV is an active phenomenon and ability, a productive way of thinking and practicing rather than a singular-cognitive ability. Thus, social skills and sensitivities alongside the ability to notice the capacities to reason are part of PV. In addition, PV is also described as the ability to think and improve practice. As Goodwin (1994) asserted, as teachers become part of a professional discipline, they are trained to look at and see a certain set of phenomena in a particular way. Consequently, the PV needs to be evaluated within a particular context. For instance, to understand teachers' PV, it is important to examine and discuss their classroom practices, understand what roles the school demands from them, and what is valued in a particular social group and school culture/system. When viewed from this aspect, it's important to note here, the PV of teacher leaders must be seen as in extended context, like considering their leadership practices beyond the classroom activities. With respect to this,

this study also considered this idea: *if you can change your vision, you can change your action.* In other words, changing one's professional vision (and professional identity) might allow his/her to see the context differently and vice versa and thus might develop a more appropriate action to promote change.

Professional Identity

Besides professional vision, another aspect of leadership is the notion of *professional identity* (PI). In the section that follows, I first provide a brief description of identity, then continue with definitions and perspectives on teachers' professional identity and conclude with a synthesis that links these three constructs, PV, PI and TL.

Sfard and Prusak (2005) describe identity as seeing and defining oneself from another person's perspective. Holland, Lachiotte, Skinner, and Cain (1998) define identity as a lived experience, a constant process and phenomena that should be explored within the social contexts in which it develops and changes, by observation, and through discourse. They further state,

> People tell others who they are, but even more important, they tell themselves and then try to act as though they are who they say they are. These self-understandings, especially those with strong emotional resonance for the teller, are what we refer to as identities. (Holland et al., p. 3)

PI has been defined in diverse professions in a wide spectrum of literature. Weinrach, Thomas, and Chan (2001) define the term as "the possession of a core set of values, beliefs, and assumptions about the unique characteristics of one's selected profession that differentiates it from other professions" (p. 168). Slay and Smith (2011) define PI as one's professional self-concept based on attributes, beliefs, values, motives, and experiences. Other scholars indicated that PI provides a constant foundation of locus that helps individuals to understand their

experiences both in their profession and lifecycle, and to gain a sense of belonging and individuality (Friedman & Kaslow, 1986; Heck, 1990). Although PI is viewed as a solid structure of an alliance of values by these definitions, based on other perspectives, PI is formed over time by contextual factors.

Clarke, Hyde and Drennan (2013) highlight the richness and complexity of the notion: "Professional identity is not a stable entity; it is complex, personal, and shaped by contextual factors" (p. 8). Considering critical and essential aspects, PI is perceived as a process in which it does not reflect who we are at the moment, but it answers who we desire to become (Beijaard, Meijer & Verloop, 2004), and it is a continuing process of interpretation and re-interpretation of practices (Beijaard et al., 2004; Day, 1999; Kerby, 1991). According to Beijaard et al., the process of identity formation is a complex phenomenon as it contains numerous knowledge sources, like knowledge of affect, human interactions, and context of particular circumstances. Apart from the definitions provided above, Gray (2001) provides a different definition of professional identity. Gray states professional identity involves "understanding and having a sense of pride in one's profession. This sense of pride is essential both for one's own internal satisfaction with one's chosen career and for the continued societal recognition of the profession" (p. 12).

PI has been defined differently depending on a particular profession's essential roles in diverse disciplines, like counseling (Emerson, 2010), nursing (Serra, 2008), and law (Floyd, 2002). The common point of the studies is that professional identities influence relationships, roles and functions, talents, professional engagement and success, and decisions on career and moral choices. On the other hand, related to the current study, the area of identity and identity formation is growing in teacher education (Beijaard et al., 2004; Bullough, 2005; Coldron &

Smith, 1999; Rhoades, 2007; Samuel & Stephens, 2000). Coldron and Smith hint that professional identity of teachers is established by their backgrounds and classroom practices, personal characteristics, and their roles as teachers. Teacher's professional identity consists of their norms and values about teaching and learning jointly with their role in the practice (Mitchell, 1997). According to Talbert (1995), this identity formation is established through involvement in multiple contexts, with teaching being in the center of it. Bullough (2005) notes, "identity formation is not a passive but a dynamic affair, that involves a giving and a withholding which simultaneously alters oneself and one's context, with the result that alternative identities may form" (p. 146). In a similar vein, Kogan (2000) argues that the nature of professional identity is both individual and social; in other words, individuals' weak or strong points are the outcomes of their expertise, moral and conceptual frameworks, and range of roles they have taken on by personal willingness and/or organizational assignments. Besides these individualistic and sociological perspectives of the phenomena, Beijaard et al. (2004) suggest that researchers who study teachers' professional identity should give priority to the role of context in PI formation as well. Thus, Helms (1998) suggests that teachers' professional views of subject matter are linked to how they perceive themselves as teachers of the content as well as their individual places in society.

As an overall approach, Gee's (2000-2001) four interrelated domain model- *ways to view*- of identity provides a broader spectrum to comprehend the notion of professional identity. These four domains are: (1) Nature: identity (we are ''what we are primarily because of our *nature*"); (2) Institution: identity ("we are what we are primarily because of the positions we occupy in society''); (3) Discourse: identity (we "are what we are primarily because of our individual accomplishments as they are interactionally recognized by others"; and (4) Affinity:

identity (we ‘‘are what we are because of the experiences we have had within certain sorts of *affinity groups*” (p. 101).

Gee’s (2000-2001) interrelated domain model and others are vital to understanding the developmental process of professional identity (as being “a certain kind of person”, p. 100). The model reflects a proficiency that may be used to enlighten studies in the area of teacher leadership and is explained in following section.

Possible Relationships among Teacher Leadership, Professional Vision & Professional Identity

The literature review above briefly focuses on the definition of PV and PI. However, due to lack of research connecting these two notions, this section is constructed around three themes, including links between PV and TL, PI and TL and then the hypothetical liaison among these constructs: PV, PI and TL. I claim that these dynamic and progressive notions have intimate connections in regards to common points, including the reality of their evolving process and ways they nurture each other similar to the links of a chain. However, there has been a lack of literature exploring the connections and relationships between PV and TL, and PI and TL.

In association with the idea of professional support to develop professional vision, there has been a little research about the links between PV and TL. There have been, however, some exemplary studies about leadership that have shown the value of professional vision, its practicality, and its role in improving teacher leadership practices. Criswell and Rushton (2013) produced a framework in their study by merging Goodwin’s (1994) notion of professional vision and Dempsey’s (1992) four metaphors for teacher leaders (*teacher as fully functioning person, teacher as reflective practitioner, teacher as scholar, and teacher as partner in learning*) as a tentative model to empower the professional development practices for 16 Master Teacher

Fellows (MTFs)—6 in one cohort and 10 in another cohort. In their longitudinal qualitative study, Criswell and Rushton used video clips to assess PV, PI, and leadership practices. The authors argue that PV can provide innovation in the teacher leadership field. The authors found that the participants realize the changes in meaning of PV and PI as they practice new teacher roles, like leadership roles, over time. This adds an important facet to the traditional conceptualization and/or process of teacher leaders' PV in a broader framework. This conclusion echoes Bybee's (2010) claim on PV. Bybee (2010) argues understanding PV of leaders (i.e., teacher leaders) might require having long-term perspective and seeing a larger picture of systematic issues, especially in science education due to its increasing demands and importance in today's education system. Muijs and Harris (2007) discuss the idea of shared vision: "As a consequence of this shared vision, it is felt that teacher leadership is being facilitated, supported and enhanced within the school." (p. 119). The authors argue that when teachers, especially teacher leaders, are more involved in helping their school system, this process can provide them a better understanding of decision-making and application by virtue of a collective commitment to being successful in implementing the new ideas or solutions. Thus, PV in leadership can be portrayed as an adoption of specialized competencies unconsciously and consciously, considering sophistication of one's ability to constitute a set of different perspectives concerning teacher leadership roles and actions. In this point, school culture and professional learning communities play significant roles; and I addressed this in the following sections.

As this literature review illustrates, however, little research has systematically investigated PV specifically in terms of teacher leadership and how PV and TL influence one another. Blomberg et al. (2011) claim their study shows: "the need to link the concept of professional vision as an in the moment construct to broader more stable concepts incorporating

norms and beliefs equivalent to… teachers' vision" (p. 1139). I believe that including professional vision in an understanding of leadership development processes can contribute to the literature by making progress in knowing what would be the most proper way to nurture the teachers' capacity and facilitate the emergence of their highest potential in becoming fruitful teacher leaders. Therefore, this study would be a strong foundation on which to build further research about the relationship between PV and TL and whether PV nurtures achievement of TL roles, or vice versa.

PI is also accepted as essential component of TL. However, only a few studies in education (e.g., Cortez-Ford, 2008; Criswell & Rushton, 2013; Jonsdottir, 2012) focus on PI, serving as a useful starting point for understanding this realm of teacher leadership. In her dissertation, Jonsdottir (2012), investigated: (a) how the professional roles and leadership of preschool teachers were perceived by the teachers and other stakeholders, and what contextual factors affect the preschool teachers' role and leadership; and (b) how preschool teachers perceived their PI and how the stakeholders' perceptions and relevant contextual factors appeared to affect this. The research found that the preschool teachers were inclined to focus on their professional roles, linked to where they saw themselves (their PI) as professionals and experts. Specifically, this study provided significant results: First, leadership within preschools is generally perceived as a traditional concept, like superficially perceiving. Second, PIs or how they see themselves as professionals and leaders among the teachers is influenced by stereotypical perceptions of some of the stakeholders.

Criswell and Rushton (2013) explored the way in which the notion of PI might add a layer of sophistication to their TL model as they re-examined and revised their initial model. Criswell and Rushton present the concept of PI as a notion related to TL; and they claim that the

formalizing of a PI arises when an individual is capable of developing a PV. In other words, the authors argue that as teacher leaders' PI matures, they need to reshape their PV to become more effective leaders in their professional communities.

Regarding the term *leadership identity*, Komives, Owen, Longerbeam, Mainella and Osteen (2006) described leadership identity as moving from a leader-centric view to one that embraced leadership as a collaborative, relational process. Although this study focused on students' leadership identity formation, components of this leadership identity theory enlighten the teacher leadership literature in terms of recognizing the systemic nature of leadership. Significant components included (a) *developmental influences* (i.e., adult and peer influences, meaningful involvement, and reflective learning); (b) *developing self* (i.e., deepening self-awareness, building self-confidence, establishing interpersonal efficacy, applying new skills); (c) *group influences* (i.e., engaging in groups, learning from membership continuity, and changing perceptions in groups); (d) *changing view of self with others* (since group members are depended upon one other; (e) *broadening view of leadership*; and (f) *leadership identity* (as central stage).

Regarding leadership development as identity construction, Carroll and Levy (2010) focus on places in leadership development where working on identity enhances a sense of agency. The authors draw on three narratives demonstrating three different identity strategies for a *space for action* that were collected from participant data from two long-term leadership development programs. They conclude that shifting the process of identity construction and reconstruction must require focusing on *what to do*, instead of what kind of person to be.

In terms of constructing teacher leadership identity (TLI), Cortez-Ford's dissertation study (2008) examined the narratives of nine elementary school teachers' in formal leadership positions. To address the question what is the constructivist path for teachers in creating a leader

identity, the author examined participants' autobiographical narratives in which they answered an essential questions: *Who am I?, Where am I?, How do I lead?,* and *What can I do?* (Katzenmeyer & Moller, 2001). The authors claimed that teachers construct a teacher leader identity. However, their findings show each teacher's struggle in PI construction/formation depended on new roles between personal and professional selves, polarized views of leadership, and teaching and leading. Thus, to grasp how teachers come to understand themselves as teacher leaders is not a straightforward process and may require professional support by means of conceiving leadership roles.

In summary, the literature illustrates that professional [leadership] identity and vision, has a significant role that frames the teacher leaders' professional performance, and leadership functioning. However, reflecting on the entire literature, although professional identity and professional vision alone do not establish success of leadership, they are inclined to affect leadership effectiveness and provide a framework in which teacher leaders may choose to lead. Thus, by virtue of their awareness and capability of forming their PI and PV, teacher leaders can most likely make vital decisions on their PIs and their leadership practices in order to perform adequately. Teacher leaders recognize and/or re-organize their PV and PI to enable and to understand their strengths and weaknesses or capability to take responsibilities and to renew themselves. To understand their own ability to do that, their direct-reflections on their practices and themselves are fundamental.

I believe that PV, PI, and TL affect one another. In conceptualizing my study, the primary mechanism among PI, PV and TL would be summarized in this way: PI is a dynamic process of self-awareness, knowledge and understanding with regard to the profession's successful and frustrating experiences, teachers' philosophy, self-esteem and professional

beliefs; PV is another dynamic process of understanding the roles, functions and practices of teacher leaders, and engagement. As the beliefs and values (i.e., PI) influence leadership performance, I believe PI nurtures PV and they, as significant dimensions of teachers and TL, provide a framework and/or another analytical aspect for TL practices.

Professional Learning Communities

Teachers may not know how to work with colleagues in a collaborative culture. Professional learning communities (PLC), therefore, give benefits for teachers to effectively overcome the challenges they face. Recent research studies emphasize that PLC's have become quite commonplace in education and these communities provide opportunities for teachers to work collaboratively with colleagues on particular learning goals.

McLaughlin and Talbert (2001) assert that strong professional cultures can be carried out as long as teachers focus on their collective experiences for solutions. Professional learning communities play a significant role in creating strong collaborative cultures. There are several reasons for schools to encourage teachers to achieve school goals through collaboration in working groups, efficient learning, reducing isolation, developing teacher's pedagogical content knowledge, and creating new ways to increase positive outcomes in teachers' and students' learning and schools achievement (Mundry & Stiles, 2009). To accomplish and sustain positive outcomes, the following characteristics should be included in a PLC: (a) collective responsibility; (b) collaborative and collegial interactions to provide positive sharing environments and reflective dialogs; and (c) professional and shared vision, goals, norms and values (Fullan, 2002; Hord, 1998). Bransford, Brown and Cocking (1999) have framed four characteristics of an effective PLC in detail: (a) learner- centered atmosphere (to focus on teachers' experiences), (b) knowledge-centered atmosphere (to focus on teachers' pedagogical

content knowledge), (c) assessment-centered atmosphere (to provide continuous feedback and endorse self-reflection), and (d) community-centered atmosphere (to foster collaboration and collegial relations). Besides these characteristics, other scholars suggest essential structures to create effective teams, including the identifying of one or more specific goals that teams can work together to achieve. These include identifying expectations of how they can work together, translating those goals into collaborative commitments, and monitoring their professional relationships/actions to develop capacities to meet new expectations and maintain ongoing activities (Dufour & Marzano, 2011; Lencioni, 2005; Patterson, Grenny, Maxfield, McMillan & Switzler, 2008).

Research suggests that teacher leaders can help other teachers in creating goals, recognizing the changes that are needed to strengthen teaching and learning, and working collaboratively towards improvement (Leithwood & Riehl, 2003). In a review of research on teacher leadership, York-Barr and Duke (2004) concluded that teacher leaders have an enormous impact on others in enhancing teachers' intellectual inspiration, and improving and presenting their professional knowledge. As Bambrick-Santoyo (2013) states, **"**Schools ask teachers to do so much beyond the classroom, everything from planning school wide events to facilitating committees. But the most influential ability teacher leaders have— and the most overlooked—is to help other teachers grow." (p. 49). In a supportive manner, Liston, Borko and Whitcomb (2008) identify teacher leadership with two main roles: formal roles and informal roles such as leader of PLCs. Effective teacher leaders (like team leaders) are able to help team members with clarifying their purpose and goals, focusing on the right work, identifying and noticing the nature of the work they should focus on as a team, and continually improving the effectiveness of their PLC (Thompson, Gregg & Niska, 2004).

As stated in literature, teacher leaders are in a significant position in terms of making decisions that affect the overall success of a learning community (Englert & Tarrant, 1995; Berry, Johnson, & Montgomery, 2005; Vescio, Ross & Adams, 2008). Katzenmeyer and Moller's (2001) definition of TL refers to importance of teacher leaders in PLCs as "teachers who lead within and beyond the classroom, identify with and contribute to a community of teacher learners and leaders, and influence others towards improved educational practice" (p. 17). To positively influence others' professional learning, "communities should support teachers in making decisions based on their contexts, their goals, current and new professional knowledge, and the needs of their students" (Vescio et al., 2008, p. 89). It is critical to note, as Acker-Hocevar and Touchton (1999) concluded, "The influence of teachers in the system is a combination of how well they know how to work the system, their perceived expertise, the influence afforded them, the collective agency of the group, and the norms within the school district" (p. 26). That is, the schools cannot achieve success of the overall goals without teacher leaders translating these goals into specific goals for each team. Thus, all teachers are in need of additional guides or leaders (i.e., teacher leaders) to know their roles in order to help the school system run productively.

PLCs consist of groups of educators, administrators, other stakeholders or district members who cooperatively work to improve the professional growth of teachers and students with the main focus of the common goals for school success. PLCs can be composed of school-based, district-based, cross-district, or national groups that define particular challenges, and carry out their decisions to improve effectiveness of teaching and learning through collaboration (Annenberg Institute for School Reform, 2003). A PLC's focus depends on previously determined needs. This study illustrated how collaborative PLC culture consisting of educators

(i.e., I-LEAD project leaders as educators) contributes in shaping desired outcomes in developing teacher leaders' (MTFs') leadership characteristics and professional vision and identity.

Professional Development for Teachers

Professional Development (PD) activities embrace pre/in-service seminars, demonstration lessons, summer institutes, action research, co-teaching, peer coaching, team teaching, book clubs, study groups, learning communities, and mentoring (Ball & Cohen, 1999; Gearhart & Wolf, 1994; Greenleaf et al., 2001; Grossman et al., 2001; Loucks-Horsley et al., 2010; Schifter & Fosnot, 1993). On a formal level, workshops and courses are the most common types of PD experiences that are available to teachers (Weimer & Lenze, 1994). Another common form of PD involves peer observation, useful for its ability to facilitate reflection on teaching and professional vision and to identify areas that are in need of improvement (Donnelly, 2007). Professional development includes formal, structured topic-specific seminars provided on in-service days as well as everyday, informal hallway discussions with other teachers about instruction techniques, embedded in teachers' everyday work lives.

A substantial body of literature has researched many effects of PD, for instance, on teacher learning (Ball & Cohen, 1999; Leiberman & Grolnick, 1996; Opfer & Pedder, 2011), on teacher change (e.g., Banilower, Heck & Weiss, 2007; Birman, Desimone, Porter & Garet, 2000; CCSSO 2009; Desimone, 2009; NSB, 2012), on effectiveness and characteristics of effective programs (e.g., Banilower et al., 2007; Jeanpierre, Oberhauser, & Freeman, 2005; Johnson, Kahle, & Fargo, 2007; Wayne, Yoon, Zhu, Cronen, & Garet, 2008), on teacher reflection (Fishman, Marx, Best & Tal, 2003), and on professional development facilitators (e.g., Jeanpierre et al., 2005).

The No Child Left Behind (NCLB) legislation (US Department of Education (USDOE), 2002) developed a vision for PD based on rigorous and sustained preparation around tangible tasks focused on content and pedagogical knowledge, connected to specific standards for student performance, and embedded in a systemic and school context. According to the NCLB, PD includes activities such as:

- improving and increasing teachers' knowledge of the academic subjects the teachers teach to enable them to become highly qualified;
- giving teachers, principals, and administrators the knowledge and skills to provide students with the opportunity to meet challenging state academic content standards and student academic achievement standards;
- supporting the recruiting, hiring, and training of highly qualified teachers, including teachers who became highly qualified through state and local alternative routes to certification;
- advancing teacher understanding of effective instructional strategies that are based on scientifically based research and strategies for improving student academic achievement (USDOE, 2002)

Despite the potential benefits associated with long-term integrated PD activities, many teachers still appear to receive the bulk of their PD through some form of the one-shot workshop (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). Survey data from the National Center for Education Statistics (NCES) (2001) illustrate that in 2000, teachers on average spent about a day or less in PD on any content area. Of those who participated in the NCES (2001) study, only 18 percent of teachers felt that the training they received was connected to a great extent to other school improvement activities, while 10 to 15 percent (depending on the content area of the

training) reported that they were given significant follow-up materials or activities. The proportion of teachers who felt their professional-development activity significantly improved their teaching ranged from 12 to 27 percent (NCES, 2001).

The disparity between the potential benefits of professional development and the actual benefits received can be explained by the fragmented delivery of the activities (Borko, 2004). The studies that Yoon et al. (2007) examined suggest a direct correlation between the duration of PD and its impact. It can be deduced that PD is more likely to affect student achievement when extended over a longer time period. Of course, the effectiveness of a PD program cannot only be associated with the duration of the program as there are too many variables that could play a vital role in the outcome, e.g., learning environments, school policies, teacher attitudes towards change, and testing. For example, most often, PD activities fail to take into account teachers' metacognition and result in ineffective delivery (Fishman et al., 2003). Thus, it is important to examine what makes PD effective.

Key Components of Effective Professional Development.

Effective PD is seen as increasingly vital to school success and teacher satisfaction. With schools today facing an array of complex challenges, including working with an increasingly diverse population of students, integrating new technology in the classroom, and meeting rigorous academic standards and goals, observers have stressed the need for teachers to be able to enhance and build on their instructional knowledge with effective professional supports (National Commission on Teaching & America's Future, 1996).

Empirical work has resulted in enunciation of key characteristics of effective PD for teachers (e.g., Borko, 2004; Jeanpierre et al., 2005; Loucks-Horsley et al., 2010; Loucks-Horsley & Matsumoto, 1999; Putnam & Borko, 1997). To create effective and continuing learning

opportunities, Loucks-Horsley et al. (2010) listed several principles of quality/effective PD experiences. PD experiences must: (a) address student learning goals and needs; (b) be driven by well-designed images of effective classroom learning and teaching; (c) provide opportunities for teachers to build their content and pedagogical content knowledge skills and examine and reflect on their practice; (d) be research based and engage teachers as adult learners in the learning approaches; (e) support teachers in deepening their professional expertise throughout their career and in serving in leadership roles; (f) be continuously evaluated to ensure a positive impact on teacher effectiveness, student learning, leadership, and the school community; (g) provide a link to other parts of the education system; and (h) provide opportunities for teachers to work with colleagues and other experts in learning communities to continually enhance their practice.

There are also research findings that emphasize the identification and removal of barriers for effective PD programs and activities, including but not limited to administrator support, alignment with district policies, alignment with district/state tests, and inclusion of follow-up support (Anderson, 2003; Cohen & Hill, 1998; Guskey & Sparks, 2002). Another barrier is defined as inefficacy of short-term PDs. Boyle, Lamprianou and Trudy (2005) assert that although traditional approaches to PD, short workshops or conferences, foster teachers' awareness or attention in strengthening their knowledge and skills, these approaches might not be sufficient to encourage learning that helps teachers to revise what to teach and how to teach (Shields, Marsh, & Adelman, 1998; Weiss, Montgomery, Ridgeway, & Bond, 1998). The literature illustrates that for the majority of teachers, PDs are perceived as one-time workshops in which they listened to specialists in the field without active participation or discussion of their own practices (National Foundation for the Improvement of Education, 1996). Further, based on US Department of Education's (1999) national survey results, a large majority of teachers

reported that their PD activities did not exceed eight hours during the previous educational year even if the activities offered in-depth study in the teacher's principal professional area.

From the work cited above, it appears that there is consensus regarding what constitutes effective PDs. Yet, as Birman et al. (2000) and Loucks-Horsley et al. (2010) state, much of the PD being offered to teachers does not reflect such effective characteristics. PD programs without well-designed and continuous professional support are not capable of long-term success in effectively addressing needs. Loucks-Horsley et al. assert that before training teachers, researchers, expert practitioners, school managers, and other related educators must work together to organize PD using the most effective and functional strategies, e.g., reform-based curriculum/strategies and particular demands in particular grade levels.

Developing Leadership Skills through Professional Development.

Teachers are not born with abilities, or having a little skill to lead colleagues. However, it is also believed that leaders are born with unique abilities: "In some cases, people are leaders because they have unique abilities that qualify them to lead. In other cases, there are people who are leaders because they are in positions of power and authority" (Bybee, 2010, p. 167). In either case, teacher leadership (TL) progresses through professional experience and practice. Gess-Newsome and Austin (2010) and York-Barr and Duke (2004) portray teacher leadership as an evolving process. According to the scholars, TL characteristics are not congenital; they are nurtured though colleagues' and administrator's support as well as participation in local, district, state and national committees or organizations. Thus, TL is seen as a key vehicle for school improvement and renewal as teacher leaders share leadership roles while implementing and supporting school improvement initiatives. When schools allow teachers to participate in the decision-making process, teachers' leadership skills develop in terms of problem solving and

interactive communication (Buckner & McDowella, 2000; Gehrke, 1991). Teacher leaders need to be inspired and supported in order to acquire facilitative leadership to impact a school community.

When teacher leaders engage in leading practices either at their school or outside of their current environment, the accomplishment is inevitable. According to Carroll and Levy (2010), "[Leadership] development could and should enact the mind-set and practices that it is attempting to instill and embed. That is to say that one *practices* leadership in the process of developing it**.**" (p. 228). Bambrick-Santoyo (2013) claims that practice is the heart of the quality of the position (e.g., mentoring, coaching, and teaching leadership) as strong leadership skills don't automatically come from only strong teaching skills. Using a cooking analogy, the author explains the evolving process of teacher leadership:

> For some cooks, creating a new dish could mean spending years perfecting the fine arts of sautéing, stirring, and simmering. But for someone who really wants to break into the culinary world, it means an apprenticeship with a master chef who'll put them to work *doing* all of that—and doing it right (p. 48).

Bambrick-Santoya believes teacher leaders are given rich opportunities to practice several aspects of the leading process. For instance, the principal's role is fundamental: "When principals recruit their strongest teachers to share in this work, they lock in growth for every person in a school: teacher leaders, teachers, and, most important, students." (p. 49). Reducing or adjusting the teacher's course load is sometimes offered as a way to avoid overloading teacher leaders. In Smylie's (1992) quantitative study, 116 (K-8 grade level) teachers from a midwestern suburban school district completed surveys to measure their willingness to participate in leadership tasks if given the opportunity. In the results, it is not surprising that teacher-principal

relationships have the greatest influence on willingness to participate. In another study, Anderson (2003) interviewed teachers to understand the nature of teacher leadership and found that the key influences depend on relationships between teachers and principals in sharing expertise, balancing power, and achieving a sense of ownership. Such abilities provided mutual advantages for the principals in lightening their workload and for the teachers as leaders in enriching their expertise outside the classroom.

Muijs and Harris's (2007) study illustrates that teacher leadership is not developed only in the school. Their findings show that teacher leaders need support either from their schools or other external PDs. In addition, if teacher leaders are supported by both school culture and external PD activities, teacher leaders are encouraged to take more responsibilities. As the authors claim, it is clear that leadership development requires strong support and specific forms of PD for teachers.

The number of TL training programs and endeavors has increased over the past decade (Smylie, 1995; Sherrill, 1999). TL development opportunities are increasing for teachers throughout their careers in a variety of ways. These opportunities include but are not limited to teacher-education programs, school-university partnerships, and other PD programs that deal with particular obstacles to practicing effective teacher leadership (Miller et al., 2000).

In their case study of 12 elementary teachers, Suranna and Moss (2000) investigated teachers' perceptions of what factors influenced the development and performance of their leadership roles. Results of the study suggest that understanding how teachers perceive the notion of TL explains the level of teachers' contribution to the reform of their profession. In addition, this study reveals lack of teacher leaders' understanding of TL roles (both formal and informal), and teachers' major focus on teaching rather than being charged with leading

committees and other professional development endeavors.

Another study (Can, 2009) includes 20 elementary school principals and 60 teachers. Can stresses that teachers need PD programs since they express that they feel insufficient themselves in their leadership ability. Swanson's (2000) study of 10 exemplary teacher leaders over 2 years explored what experiences contribute to the development of teacher leaders. Results indicated that teacher leaders need maturing intellectual expertise in pedagogical content knowledge and in professional networking in terms of having high level of collaboration, reflection, flexibility and empowerment for sustainable learning to be effective leaders. It was also emphasized that continuing and high quality PD activities enhance teacher leaders' reflective perspective, collaboration, professional networks and so their careers. The author found that intensive and extensive high-quality PD was perceived to have contributed to the development of the teacher leaders. Thus, it is important to note here that TL developmental process should function with well designed activities considering phases of the TL developmental process; that is, by teacher educators who have invested accurate proficiency to address particular needs (i.e., in this study, I-LEAD project aims to improve TL).

Recently, Riveros, Newton and Costa (2013) examined 21 teachers' and administrators' experiences and how their participation in this initiative influenced their understanding of teacher leadership through a *cascade* model of TL professional development. In this case study, the participants recognized their participation in the TL program as contributing to their career development. The authors have also found that teacher leaders need flexible structures in the school, which facilitate teacher leaders' development of trust and collegiality with their peers.

Developmental influences facilitate leadership identity development (i.e., systematic thinking) as well. Some leadership scholars in identity development believe that the role of key

events and critical incidents in the development of leadership are equally important (McCall, Lombardo, & Morrison, 1988). McCall et al. identify key events as challenging assignments that impact leadership growth; however, Komives, Owen, Longerbeam, Mainella and Osteen (2005) state that leadership development is not about the key events; it is about a psychological dimension of developing interdependence, establishing nourishing interpersonal relationships, and building a confident sense of self. In this study, the authors also argue that multiple social identities and factors in developing self are crucial in developing a leadership identity. In sum, individuals first discover, and then form their identities within a social context that develops over time. However, the critical point here, as Albino (2013) states, a leader might fail to adhere to his/her *authentic personal leadership identities* unless one knows who s/he is, and listens to the voices of his/her respective identities. "If we can manage to hang on to the values and beliefs that helped us to grow as professionals, or simply as human beings, then we have the foundation for our personal model of strong and ethical leadership" (p. 145). Thus, as it is obviously seen, all these critical occurrences impact teachers' leadership identity, and leadership growth.

With respect to practice-based leadership development, Rhodes and Brundrett (2006), in their case study, present several central elements of leadership development: empowerment, support, risk taking, confidence-building, and opportunities to experience other educational contexts outside of their school environment. Finally, developing leadership is defined also by Loucks-Horsey et al. (2003) as "one of the major purposes of professional development programs" (p. 96). They state that leadership and support are required for involvement in PD to be transformative to teaching and learning. According to Loucks-Horsey et al., teacher leaders (i.e., MTFs) play a critical role in influencing and potentially reforming science education and bringing about educational change.

Professional Development for Quality Science Teaching in Middle and High Schools.

The National Science Education Standards highlights the importance of teacher professional development and states, "Becoming an effective science teacher is a continuous process that stretches from preservice experiences in undergraduate years to the end of a professional career" (NRC, 1996, p. 55). PD programs, therefore, are aimed at enhancing the quality of teaching and learning by helping teachers augment and bring up to date their subject knowledge, develop new teaching and learning practices, sharpen their existing skills, and engage them in professional growth as teachers (Borko, 2004; Davis, Petish, & Smithey, 2006; Richardson & Placier, 2001). Focusing on PD activities as a means of improving teacher quality and improving teacher effectiveness in classrooms is at the heart of efforts to improve the quality and performance of public schools, which will, in turn, translate into higher levels of student achievement (Supovitz & Turner, 2000).

States and school districts have instituted and led PD programs to respond to the call for high-quality teaching and learning. According to National Science Foundation's (NSF) science and engineering indicators (NSB, 2012), in 2007, more than three-quarters of mathematics and science teachers in public middle and high schools were engaged in PD on the content of their teaching subject during the previous 12 months. In a study in which Miles, Odden, Fenmanich, and Archibald (2004) investigated the total costs of PD across a large sample of districts, it was found that $4,380 is spent yearly on average per teacher. To carry these efforts, the Federal government has provided substantial financial support to K-12 education institutions to design systemic and innovative educational reform strategies for improving student achievement and to narrow performance gaps. NSF, for instance, has provided funding for programs addressing

critical issues and infrastructure needs regarding the preparation, induction, retention, and life-long development of K-12 STEM education, e.g., Math-Science Partnership, the Teacher Professional Continuum, and the Teaching Fellowship/Master Teaching Fellowship programs.

Among many factors that affect student learning, teacher quality is imperative. To ensure that high-quality teachers guide all classrooms, NCLB mandated that schools and districts hire only highly qualified teachers in core academic subjects such as science and mathematics. According to NCLB, in order to be deemed highly qualified, teachers must be fully licensed, demonstrate content knowledge competence, and hold a minimum of a bachelor's degree. Teaching quality has remained in the national spotlight (USDOE, 2002). In 2007, 70% of science teachers in public middle schools were teaching in field. In high schools, large majorities of biology/life science teachers (93%) and physical science teachers (82%) taught in field (NSB, 2012) [Nearly one fourth (23%) of all secondary teachers do not have even have a college minor in their main teaching field...More than half of physical science courses are taught by teachers who do not have backgrounds in these fields (National Commission on Teaching & America's Future [NCTAF], 1996)]. Evidently, there is a need for more highly qualified science teachers.

Improving teacher quality and teaching effectiveness in U.S. schools, particularly in science has become more important in the 21th century. The pressing need for high quality science teaching has become a critical concern across the nation, e.g., *Teaching at Risk: A Call to Action* brings to mind that teaching is "nation's most valuable profession" (The Teaching Commission, 2004, p. 12). There is no doubt that PD programs and activities are key to reforms in learning and teaching of science. The demand for PD is huge, given the low performance of U.S students in science, large numbers of science teachers who enter the teaching profession on provisional certification, and the number of science teachers who teach out of field (NCES,

2007, 2011; NCTAF, 1996). The standards-based reform movement affirming the need for high-quality K-12 science teaching and learning, and improved student achievement has placed increased pressure on schools and districts to offer targeted PD to teachers (NRC, 1996, 2000). The movement necessitates K-12 science teachers to have pedagogical content knowledge of subject matter that is most effective for teaching the subject.

Current studies in science education have also revealed the importance of new (reform-based) instructional strategies for science teachers to fulfill quality of teaching in science. For instance, Luft, Bell & Gess-Newsome (2008) believe that new instructional strategies provide engagement and interaction (student/student and student/teacher) and foster students' motivation and interest in science. Teachers' commitment to effective science teaching is required, including creating interest and student participation, generating curiosity, eliciting responses that uncover learners' current knowledge of the phenomena or concept being studied, and motivating learners (Bybee, 1997; Carin & Bass, 2001).

To create effective science teaching, and establish effective PDs for science teachers, Loucks-Horsley et al. (2003) listed seven tenets. These tenets include: (a) developing a well-defined image of the learning environment from a teaching and learning perspective, (b) providing sustained opportunities for teachers to build and develop their professional knowledge and skills, (c) modeling specific teaching and learning strategies for teachers to use with their students, (d) forming a professional learning community, (e) supporting the growth of teachers as leaders, (f) providing deliberate links to other parts of the education system, and (g) providing an enriched context for constant assessment and improvement of teaching and learning. Other researchers as well (e.g., Birman et al., 2000; Darling-Hammond & McLaughlin, 1995; Lieberman, 1995; Little, 1995) echoed similar principles of effective PD.

The Importance of Professional Development for Elementary Teachers.

The need to strengthen science education in the United States has been widely recognized in numerous education policy documents of the 1980s (American Association for the Advancement of Science [AAAS], 1989), and has resulted in documents declaring the priorities and agendas for reforming K-12 science education (e.g., AAAS, 1989, 1993; National Research Council, 1996). Internationally, in 2007 *Trends in International Mathematics and Science Study* (TIMSS), 15% of U.S. fourth-graders (among thirty-six countries or educational jurisdictions) and 10 percent of U.S. eighth-graders (among 48 countries or educational jurisdictions) scored at or above the advanced international benchmark in science (National Center for Education Statistics [NCES], 2007). Nationally, most of the students who took 2009 National Assessment of Educational Progress (NAEP) science assessment failed to reach the proficient level. Of those students, 34% of 4th graders, 30% of 8th graders, and 21% of 12th graders performed at or above the proficient level in science. These unfavorable results illustrate the demand for improvement of elementary science teachers. There are numerous barriers to good science instruction at the elementary level. The majority of elementary schools allocate very little time for teaching science, and many elementary teachers prefer not to teach science (Mulholland & Wallace, 1996; Roychoundhury, 1994; Moore & Watson, 1999; Stevens & Wenner, 1996). The statistical results show that 25% of all elementary teachers do not teach science, or teach less than two hours per week of instructional time (Gess-Newsome, 1999).

Reasons for teachers not to teach science or to teach science not an effective way can be itemized as follows: (a) spending more time on reading and math teaching; (b) having lack of science background; (c) having limited reform-based instruction strategies; (d) focusing on standardized test scores (Brand & Moore, 2011); (e) lack of teachers' efficacy beliefs (Bandura,

1977); (f) lack of preparation in science content (Zembal-Saul, Blumenfeld, & Krajcik, 2000); (g) being pushed by curriculum and standards; (h) limited resources; (i) having the tendency to teach the same way they were taught (Marek & Cavallo, 1997); or (j) lack of knowledge of how and when to use resources and materials (Novak, 1988).

These types of challenges, deficiencies and fears of teaching science could be transformed into effective competence of elementary teachers in science teaching by effective PD programs. Based on inadequate recent practices, elementary teachers need to grow professionally, by guidance and support to accommodate reform-based vision in science education. In that sense, much of the research on PD programs for elementary teachers has been concerned with qualifications and characteristics of the PDs to cover the teachers' needs and the necessity to facilitate new and developmental changes in an educational era. Many research studies indicate that elementary teachers do not have proper views of science and related instructional strategies; however, PD programs can help to improve elementary teachers' content knowledge and teaching practices in science (Akerson & Hanuscin 2005, 2007; Akerson, Townsend, Donnelly, Hanson, Tira, & White, 2009; Bentley 2003). To accomplish this goal, teacher-driven PD activities are suggested as an alternative PD approach to provide ongoing support, addressing teachers' needs and providing mutual developmental support.

Teacher-Driven Professional Development.

As noted above regarding PD for science teachers, due to barriers such as lack of content knowledge and fear of teaching science, elementary teachers are in need of purposeful, well-designed PD activities. In association with this, the current research literature in PD asserts that when experienced teachers are provided PD programs to improve teaching practices (i.e., pedagogical and content knowledge), this networking opportunity allows teachers to collegially

interact with colleagues who are willing to collaborate and share their knowledge (Bonner, 2006; Garet, Porter, Desimone, Birman, &Yoon, 2001; Sparks, 2004; Peckover, Peterson, Christiansen, & Covert, 2006). PD can be led by research committees, strong and effective professors, teachers, and educational experts (Loucks-Horsley et al., 2010). The authors also highlight teachers as facilitators of PD activities. They claim, "experienced teachers are a resource for helping other teachers develop pedagogical content knowledge" (p. 73).

Literature cited in the TL development section indicates the significance of providing opportunities to teacher leaders to practice their leadership skills both in their own school and outside of their school environment (e.g., Rhodes & Brundrett, 2006). If a teacher leader can take his or her expertise, and share it with other teachers, a win-win situation becomes noticeable for both teacher leaders and other teachers. While teacher leaders are testing and improving themselves, others also take advantage of the colleagues' knowledge, experiences and skills. Thus, for the purpose of this study, master science teachers, MTFs, become PD facilitators (teacher-driven professional development—TDPD) to improve other teachers' instructional science knowledge.

Recent research and policy in PD advocate moving away from one-shot workshops on general topics to encouraging ongoing teacher-driven collaborative learning that focuses on particular concerns and needs (Guskey, 2003; King & Newmann, 2000; Lousey-Horskey, 2010). Thus, some research supports the direction of the current proposed study. For instance, the *Science Teachers Learning from Lesson Analysis* (STeLLA) project is a video based analysis-of-practice PD program designed for improving teacher and student learning at the upper elementary level. The teachers who drive the program are guided by a constructivist view of teacher learning, and are supported by an outside facilitator. In the pilot study of STeLLA, the

researchers have found positive effects of the teacher-driven approach for the PD facilitator teachers, including that they "improved attitudes toward teaching science and their improved sense of efficacy in driving their own professional development" (Roth, Garnier, Chen, Lemmens, Schwille, & Wickler, 2011, p. 143).

Colbert, Brown, Choi and Thomas (2008) described their particular PD model, *Collea Teacher Achievement Award Program* (CTAAP), which consists of 37 elementary and secondary teacher participants. *CTAAP* provides teachers with the opportunity to make decisions about their professional growth. Based on the interview results of this study, the PD activities designed by high school teachers as research participants helped them to gain research perspectives and provided learning opportunities, such as the use of innovative technologies and teaching techniques used by scientists in the fields of biology, physics, and chemistry. Furthermore, the researchers found that the *CTAAP* enhanced the self-confidence, self-efficacy, professionalism and perceptions of empowerment of the teachers who design and deliver TDPDs, benefitting themselves and the participating teachers.

In another study, Van Dusen, Ross and Otero (2012) investigated the process of teacher professional growth through teachers' talk about inquiry teaching and learning through TDPD. The teachers in the *Streamline to Mastery* PD program are charged with partnering with university researchers to establish a community committed to improving science education. The goals of *Streamline to Mastery* are to support teachers in improving their professional practices and to develop a community of science education leaders within the greater population of practicing teachers. To accomplish these goals, teachers work in partnership with university researchers to design professional development opportunities for themselves and for fellow teachers. During the five-year PD program, the authors analyzed videos, emails, lesson

reflections, survey responses, interviews, and teacher discourse. The major finding of the study is a shifting of roles from a hierarchical community where the researchers are experts and teachers as just learners to a more egalitarian community where everyone participates as expert learners. It is further stressed, "In a community of practice where everyone is an expert learner, there must be constant willingness to share ideas and to challenge one another's ideas, as well as an acceptance of, and affinity for, skepticism in order for growth to take place" (p. 12). Although these studies seem closely associated with the current study, this study bridged these ideas with a symbolic interactionist lens as it studies evolving teacher leaders (i.e., MTFs) rather than only ordinary experienced teachers who facilitate TDPDs.

Although there has been a lack of literature about TDPD that highlights how teachers benefit in demonstrating their leadership roles, the current studies about TDPD have shown that TDPD programs can provide learning opportunities. Further, when teachers are engaged in designing the PD, they are more motivated to take full advantage of the opportunity to enhance their learning. Professional development is more meaningful to teachers when they exercise ownership of its content and processes (King & Newmann, 2000). Sharing a similar perspective, Hiebert et al. (2003) justify the importance of the teacher's responsibility for improving both his/her own and others' teaching and learning practices, as shared practices of the profession. If teachers are open to sharing their own instructional experiences with colleagues, they can establish networks and take advantage of practicing new professional behaviors. In that sense, TDPDs organized by the Math Science Partnership (MSP) program and encouraged by the I-LEAD project team play a significant role in focusing on common issues with a collaborative approach. This shows that the TDPD programs not only enrich the training teachers' knowledge but also give MTFs the opportunity to practice their leadership skills. When considering the

entire picture, all teachers share a common goal in improving professional knowledge and ability to impact student learning and school and district success.

Conclusion

Research on PD suggests that giving teachers the opportunity to involve themselves in dialogue and collaborative actions develops the capability to identify local needs and implement solutions (Colbert et al., 2008; Peckover et. al., 2006). In addition, providing teachers with the independence to exercise professional roles (i.e., teacher leadership) and needs (i.e., inadequacies in teaching science) can provide teachers with the ability to recognize a problem and find the best solution (Bonner, 2006). Therefore, TDPD becomes an efficient way of benefiting from colleagues either within, or outside of the school, no matter what grade levels they teach. Because they are also in the teaching profession, the MTFs have been facing parallel instructional struggles so that their lived experiences enlighten PD programs and support professional growth of teachers. TDPD provides advantages especially for teacher leaders who have a critical role in cultivating other teachers and creating comfortable PLC atmosphere during teacher-driven efforts to identify and solve instructional difficulties rooted in their daily work. TDPDs can support MTFs as facilitators to overcome shortcomings in particular subject areas (i.e., science) and inspire participating teachers in demonstrating their evolving leadership skills.

Regarding leadership in the science discipline, Bybee (2010) asserts that leadership responsibilities in reforming science education include the roles of teacher educators, science coordinators, science education researchers, and classroom teachers. Furthermore, the fundamental purpose of science education is comprehensive and inclusive in terms of achieving high levels of scientific knowledge that is also required in improving professional vision and identity of teacher leaders in the 21st century. With diverse visions of teacher leaders,

participating in a community (i.e., I-LEAD and MSP programs), setting priorities, and resolving conflicts become easier resulting from recognizing many sources, extensive review and revised thoughts, beliefs, values, and actions (i.e., PI and PV). TDPD allows experienced teachers to practice their leadership roles, and potentially improve others' knowledge/skills.

In a previous section, the liaison between TL, PV, and PI based on the limited literature, the effectiveness of PD and TDPD, and the gap in knowledge about TDPDs conducted by teacher leaders is discussed. This study focuses on teacher leaders' (MTFs) leadership development process while implementing TDPD to improve other teachers' science teaching and learning practices and how this process reflects the relationships among the constructs of TL, PV, and PI. The power of the I-LEAD project is to provide teachers (MTFs) with collaborative decision-making to define the goals, establish professional networks, and identify and utilize strategies. In that aspect, MTFs collaborated with MSP programs to facilitate TDPD so as to improve pedagogy and teacher/student learning in science. Thus, in the current study, it is proposed to investigate whether the MTFs, as high school science teachers, can exhibit and/or restructure their professional vision, identity and leadership characteristics (along with pedagogical and science practices) during the I-LEAD leadership training program and as they conduct TDPD for other science teachers. In that sense, this study directly and indirectly found out whether MTFs became able to (a) revise and/or reconstruct their self-awareness of their PV and PI (e.g., values, beliefs, knowledge, needs, plans, potentials, and experiences) to better perform in leadership practices, (b) have more experience and awareness in leadership and thus improve their TL abilities, (c) monitor and transfer new educational reforms/ideas for sustainable implementation to improve effective teaching practices for both their own and followers/colleagues in science disciplines, (d) deal with obstacles/barriers with colleagues, (e)

know how to connect to resources and experts to support colleagues and learning practices, (f) create positive relationships and team culture (e.g., building trust, effective communication and problem/conflict solving strategies, and positive work environment), and (g) engage in a continuous collaborative professional learning culture in which professional development activities are designed to share knowledge.

3 METHODOLOGY

Case study research is used when the research topic must be defined broadly, and when there is a need to get in-depth information associated with influential factors. Merriam (2009) describes case study as "an in-depth description and analysis of a bounded system" (p. 40). A bounded system refers to an individual, or a single unit around which there are boundaries. From Yin's (2003) perspective, case study means conducting an empirical investigation of a contemporary phenomenon within its natural context using multiple sources of evidence. The case study method is best applied when research addresses descriptive or explanatory questions and aims to produce a first-hand understanding of people and events. Similarly, with a broader perspective, according to diverse scholars, it is appropriate for achieving in-depth inquiry, holistic knowledge, and understanding of the interactive processes and relationships for the study of contemporary issues (Lewis & Ritchie, 2003; Gengatharen & Standing, 2004; Carcary, 2009). It also allows researchers to modify data collection plans while still in the field when a conflict in data collection surfaces (Yin, 2008).

The Form of Case Study

Case study research designs provide background for particular inquiry. The four types of case study design include: *a) holistic*-single-case, *(b) holistic multiple-case, (c) embedded* single-*case, and (d) embedded multiple-case* designs (Yin, 2008). This study seems to match well with an *embedded single-case* study to explore more than one unit of analysis. An embedded single-case study defines these different participants' cases as subunits. As Yin (2003) asserts, "The same case study may involve more than one unit of analysis. This occurs when, within a single-case, attention is also given to subunit or subunits" (p. 42). The examples that are provided by Yin helped me determine the design of my case study: "For instance, even though a case study

might be about a single organization, such as hospital, the analysis might include outcomes about the clinical services and staff employed by the hospital" (p. 42). According to Yin (2003), "[T]he single case might be a public program that involves large numbers of funded projects- which can be embedded units" (p. 43).

This study focused on the individuals, as subunits or embedded units, who were trained in the I-LEAD project (as the main unit/case). In addition, to avoid the major pitfall of the embedded design (e.g., only focusing on the sub-units), and not to fail to grasp the larger unit of analysis, this study focused on the entire picture, the connections between the larger unit, the I-LEAD training program, and the subunits (MTFs' own implementations of TDPD) to understand the participants evolving leadership trajectory while implementing their leadership practices via TDPDs. Thus, regarding the boundaries of this case study, I focused solely on three MTFs' leadership developmental trajectory within the borders of I-LEAD project- from the beginning of I-LEAD to the end of MTFs' own TDPD activities within the Math and Science Partnership program (over spring and summer 2014).

The Criteria for Selection of Participants

In qualitative research, participant selection is one of the vital components of research design that requires attention before addressing the data collection of the what, where, when, and whom. Patton (2002) suggests purposive sampling for qualitative research, especially when a researcher intends to select information-rich case(s) to gain in-depth meaning from the study. Similarly, Bogdan and Bilken (2007) argue that purposive sampling is best employed when participants are selected on the basis of the characteristics that enable researchers to collect rich data. Different types of purposeful sampling include: typical, unique, maximum variation, convenience, and convenience/chain sampling (Cresswell, 2013; Patton, 2002; Merriam, 2009).

As Patton (2002) claims, "[The] logic and power of purposeful sampling lies in selecting *information-rich* cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry" (p. 230). In the context of this study, I used purposeful sampling and typical sampling as sub-approach to select my participants.

There is no defined number regarding sample size. Patton (2002) and Merriam (2009) recommend that specifying a sample size should only be connected to reasonable coverage of the phenomenon given the purpose of the study and the specific research questions. To ensure appropriate amount and diversity of data from participants, Merriam emphasizes, "The size of the sample within the case is determined by a number of factors relevant to the study's purpose. In case studies, then, sample selection occurs first at the case level, followed by sample selection within the case" (p. 82).

I used purposeful, typical sampling as the sub-approach, to select the research participants for the study. Patton (2002) asserts that typical site sampling strategy is used, "[B]ecause it is not in any major way atypical, extreme, deviant, or intensely unusual" (p. 236). However, at the beginning of the purposeful sampling, selection criteria must be determined as LeCompte and Preissle (1993) suggested, "create a list of the attributes essential… proceed to find or locate a unit matching the list" (p. 70). With respect to these, purposeful sampling was used in this study employing the following criteria for selection of participants: (1) they were experienced high school science teachers from the I-LEAD leadership training program, (2) they were engaged in leadership activities in the I-LEAD project for the longest period of time (almost three years- Cohort-I), and (3) they led science professional development through a Math and Science Partnership (MSP) program at a school other than their own during spring and

summer 2014, fitting the time frame of this study. Three people who fit these criteria and were selected to be participants in the study.

The three participants of the study consisted of two female high school chemistry teachers (Ashley and Natalie- as pseudonyms), and one male high school physics teacher (John- as pseudonym). Their years of teaching experience ranged from 5-11 years. Table 2 provides concise information on the MTFs. Each of these individuals signed a letter of commitment to participate in the I-LEAD project for five years. The reason for considering these three MTFs as evolving teacher leaders was their plans to provide outreach to other teachers utilizing TDPD activities to improve science instruction strategies. Thus, this study aimed to understand the dynamics at these professional development activities in influencing MTFs' evolving professional vision, identity and leadership performance.

Each participant was leading a Teacher Driven Professional Development course in a two-year MSP program. These courses, conducted during the second year of the MSP, were planned by the MTFs to facilitate science activities for K-12 teachers. The first participant, Ashley was a formal teacher leader as science department chair at her school. Ashley had organized a program for elementary teachers (approximately 20) in one county to be held in spring and summer 2014. The goal of this program was to increase elementary teacher's math and science content knowledge. Teachers in this program completed four courses to earn a science endorsement on their certificate. Ashley was in charge of teaching these elementary teachers the physical science content along with inquiry skills once a week in spring 2014, and for a week during summer 2014. The second participant, John, a former science department chair, worked with another MSP program, which he organized for middle school teachers (approximately 20) at different schools in another county in spring and summer 2014. The goal

of this program was to extend middle school teachers' math and science content knowledge along with lab activities and assessment strategies. John was responsible for teaching physical science every other month in spring 2014, and for a week during the summer 2014. The third participant, Natalie, who had not have any leadership background, worked with another MSP program, for 8th and 9th grade physical science teachers (approximately 20) to facilitate professional development in her school district in spring (one day in March) and summer 2014 (six days).

Table 2

Selected Information about the Master Teaching Fellows

Pseudonym	**Main Subject**	**Years Experience**	**Degrees / Certifications**
Ashley	Chemistry	13	B. S. in Life Science Educ., T-6 Broad field Science, Gifted Certification, working on PhD in Science Education
John	Physics	13	B.S. Science Education, T-5 Masters Leadership, T-6 EdS Leadership, Gifted Cert., AP Physics Certified
Natalie	Chemistry	8	B.S. in biochemistry, MAT Chemistry Educ., Chemistry and Physics Certified, Gifted Endorsement

Data Collection

The data collection in case study research is typically extensive, drawing on multiple sources of information such as observations, interviews, documents, and video-recordings (Creswell, 2013). According to Yin (2008), evidence for case studies may come from six sources: documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts. Merriam (2009), in a similar way, defines data sources within three categories: *interviews* (individual and focus group); *observations* (complete participant,

participant as observer, observer as participant, and complete observer); and *documents* (public records, personal documents, popular culture documents, visual documents, and physical artifacts). In this study, the data were obtained from archival records and individual interviews.

The data were collected with the I-LEAD project as the unit and the three possible participants' evolving leadership process as subunits. From those who agreed to participate, I collected information about their experience from a number of sources, including semi-structured interviews, archival data of I-LEAD, and curriculum artifacts of the PD plans of three MTFs made to train other teachers in spring/summer 2014. To support accurate data collection, I kept an analytic memo as a record of chronological events and the progress of research. In these memos, I noted my own reactions and reflections throughout the research process.

Table 3

Data Collection Matrix Pertaining to Research Questions

Research Questions	**Interviews**	**Archival Data**
• How do Master Teacher Fellows' (MTFs') perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development opportunities as they evolve from teachers into teacher leaders? • How do MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through their participation in an I-LEAD professional development leadership program? • How do MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development activities as they develop, facilitate, and complete Teacher-Driven Professional Development for K-12 teachers? • In what ways, do MTFs perceive their professional vision, professional identity, and teacher leadership	3 MTFs	Curriculum artifacts of both I-LEAD PDs and MTFs' PD plans; interviews with the MTFs, video recordings of PD sessions (along with transcriptions of the I-LEAD PDs as of the first year to summer 2014); online discussion threads, and reflective narratives

roles affect one another through their own leadership trajectories?

Interviews. Seidman (1998) wrote that telling stories is essentially a meaning-making process. When people tell stories, they select details of their experience from their stream of consciousness. Because I was interested in how participants' stories provide access to their meaning making of teacher leadership phenomena, I conducted in-depth *semi-structured* interviews using a dialogical approach (Hatch, 2002). These interviews used as a primary source of data collection while seeking answers to my research questions. Although I started the interviews with guiding questions to learn of the participant's general experiences and their stories, later questions followed the leads of the participants to allow for spontaneity during the interviews. Because formal interviews are in-depth and designed to go deeply into understanding of the participants, I allowed the participants' comments to continue until their ideas are exhausted and they have reached saturation (Merriam, 2009). Therefore, most questions traced from what the subject says, launched to the phenomenon as experienced, and explored the concerns of the interviewee so as not to delimit the responses.

For the purpose of this study, I conducted one individual interview (see Appendix) with each research participant to gain an understanding of their experiences relative to their evolving professional visions, professional identities, and leadership performance after summer 2014. I conducted the interview after their PD activities (January, February, and June 2015) to have the participants explain their own perceptions regarding their professional visions, professional identities and leadership skills, and how they met the needs of other teachers in science teaching and learning. The focal point of the interview was to find out about their current leadership practices and changes in their view of teacher leadership, professional vision and identity over

the course of the I-LEAD program and TDPD activities. Throughout these interviews, I focused on participants' experiences within the context of their leadership roles by allowing them to reconstruct the details of their experience. Further, I encouraged the participants to reflect on the meaning their experience holds for them and to clarify points gleaned from the archival data which may necessitate a reconstruction of the details of the participant experience as Seidman (1998) recommended. To gain full knowledge of the participants' leadership trajectory, I also explored about their goals, plans, strategies on how/why they intend to accomplish the identified purposes, and the details of their experiences and future plans. Each interview lasted approximately 50-60 minutes. I conducted all interviews in a place that was convenient for the informants, such as library and meeting rooms at their schools. Thus, I believe individual in-depth interviews assisted me in covering the understandings, meanings, beliefs, feelings, experiences and stories (Seidman, 1998) of MTFs' leadership trajectories.

Documents (Archival Data). "Documents are, in fact, a ready-made source of data easily accessible to the imaginative and resourceful investigator" (Merriam, 2009, p. 139). According to Merriam (2009) and Bogdan and Bilken (2007), there are four major types of documents: a) *public records* (as official and ongoing records of an organization's activities); b) *personal documents* (like first-person narrative/reflection which portray an individual's action, beliefs, etc.); c) *popular culture documents* (like popular/mess media forms—film, newspaper, TV shows, internet, etc.); and d) *visual documents* (like film, video-clips, photography). Prior (2003) asserts that the majority of resources can be classified as documents, including paintings, memorials, diaries, shopping lists, advertisements, tickets, film, photographs, videos, and so forth. Such documents, though they may appear insignificant, can provide data for rich understanding of phenomena. Hatch (2002) notes the importance of inconspicuous data derived

from documents that are not categorized through the perceptions, interpretations, or biases of research participants.

Thus, the documents I sought to explore are inconspicuous data that described the MTFs' field of action and some important transition points from the developmental process of leadership, from first participation with the I-LEAD project to ending point of TDPDs (summer 2011 to summer 2014). The I-LEAD project has collected considerable data from the first three years of the program including: (a) interviews with MTFs, (b) monthly video recordings of I-LEAD Professional Development sessions, (c) written reflections (narratives) by teacher leaders about their own leadership, (d) teacher leader contributions to online discussion threads, and (e) curriculum artifacts of the I-LEAD project. I first examined the I-LEAD project agendas and syllabi (curriculum artifacts) to eliminate unrelated pieces from their archival data. To determine which interviews, videos, transcriptions, reflections, and artifacts to analyze, I discussed with the I-LEAD project developers and facilitators about what archival data would help answer my research questions across the past three years of sessions and assignments. What MTFs have learned, and what influenced them the most in reconstructing their professional vision, identity, and leadership performance was crucial. Thus, I also included the participating MTFs' own professional development plans made in fall 2013/spring 2014 for their Teacher-Driven Professional Development sessions in spring/summer 2014. I believe the documents provided not only a bigger picture but also more details beyond the participants' interview answers. Finally, I rechecked with the project developers to ensure that I do not miss any relevant documents from their archival data.

Methods of Data Analysis

"In case studies, data collection and analysis are likely to occur in an intermingled fashion. This is because newly collected field evidence may pose immediate challenges to any tentative interpretations made on the basis of earlier evidence" (Yin, 2012, p. 177). When case study data have been structured and coded, a researcher then implements a number of analytic analysis strategies. Yin (2008) refers to this analytical process as a way of systematizing the data. According to Merriam (2009), on the other hand, "Data analysis is the process of making sense out of data. And making sense out of data involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read—it is the process of making meaning" (p.175-176). Merriam further named category construction as data analysis that must be done correlatively during data collection. After all sets of data are in, a period of intensive data analysis begins with essential components.

Denzin and Lincoln (2005) acknowledge that data analysis in qualitative research is ongoing as data collection proceeds. Thus, it is crucial that data analysis begins immediately post-collection or better yet, "the right way to analyze data in a qualitative study is to do it simultaneously with data collection" (Merriam, 1998, p. 162). Stake (1995) highlights that data are continuously interpreted since qualitative research is inherently reflective, "in being ever reflective, the researcher is committed to pondering the impressions, deliberating recollections and records...data *are* sometimes pre-coded but continuously interpreted, on first sighting and again and again*"* (p. 242). I used NVivo qualitative data analysis software to code and categorize the narrative text collected from archival data of the I-LEAD leadership training program (e.g., curriculum artifacts of the I-LEAD PD and TDPD programs, transcriptions of PD sessions and interviews, the participants' reflections, and/or online discussion threads) and then

semi-structured interviews with MTFs. After initial coding of archival data, I included some other questions to the interview protocol to provide the participants a platform to clarify and elaborate on some significant points that arose from the archival data. I audiotaped the individual interviews (with the MTFs) and transcribed them. Once audio files (fully transcribed interviews along with digital field notes and analytic memos*)* were transcribed, I checked for accuracy and included these data with the initial-archival data to be coded.

"Analysis is a matter of giving meaning to first impressions as well as to final compilations" (Stake, 1995, p. 71). Thus, in my research, I meticulously analyzed impressions and their interpretive nature as the analysis proceeds taking these impressions apart searching for patterns, bias and consistencies across data, episodes, categories, constructs and cases. Yet, data analysis also suggests a process of connecting meanings in an exploratory manner that benefits from analogy and metaphor (Stake, 1995). Thus, I carefully read my data with three manual coding methods (i.e., two as first cycle, and one as second cycle coding methods) to make sure about the appropriateness and full alignment to my research questions. Saldaña (2013) asserts that diverse coding/analytic approaches can be used in a study to augment accountability and depth of findings. In that sense, I used *Thematic Analysis* as my first coding method based on the significant points of my research questions to check the alignments of my research question. As Grbich (2013) explains, when

> [A]ll the data is in, it is likely that you will have a fairly clear idea what the database contains in terms of issues that are becoming evident and you will have had the opportunity to explore aspects that initially may not have been considered central to the research question/s. (p.61)

The strong point of utilizing this method is, " this process is conducted when a data set is

complete" (p. 61). As Saldaña states, a second coding phase may be needed as an advanced way to reorganize and reanalyze data. In this point, I used *In Vivo* Coding, which is also called literal, verbatim, or inductive coding, as my second method of coding that enabled me to embrace original identifying codes, such as line numbers and respondent's name. The essential method of In Vivo coding is using a word or short phase derived from participants' own expressions to capture their perceptions. This enabled me to present each participant's significant insights independently, and also emphasized their the most salient sentences or phases pertaining to each category (i.e., Ashley: "Holding Students' Accountable"; and Natalie: "The Path of leadership is not linear"). After completing these two coding process of archival data, I defined some unclear or insufficient insights of the participants that were significant in accurately address the research questions. Then, I asked these points as well during the individual interviews, and used the same first two coding methods to those interview transcriptions. I ended up some initial categories, including but not limited to *as a teacher, as a mentor, during the I-LEAD, during outreach, professional vision, and professional identity*.

I aimed to comprehend patterns that emerge and get a stronger picture of the data by grouping key segments, overarching and identifying subgroupings, and then conceptualizing these categories including literature and theory. Under this method, I incorporated etic codes. To code ethically means that the researcher judges the topic of a passage according to what the informant himself believes the topic is because in initial coding process I used the codes, which illustrated participants' own perceptions, what has meaning for them, and how they explain their experiences. In addition, during this type of coding process, I consulted the teacher leadership literature to help frame the process and provide a rationale for the name I gave a passage. Specifically, I used some key concepts of the study's theoretical framework, Symbolic

Interactionism, (i.e., interactions) and teacher leadership literature (i.e., the roles and characteristics of teacher leadership, and professional vision and identity) when necessary. For instance, as some key concepts arose related to the research questions after the first coding process, I organized first codes depending on the emergent codes, such as *influential factors* during the MTFs' leadership trajectory. Thus, I was able to identify examples of each category to illustrate what the analysis achieved that helped me to see further/bigger pictures during my initial data analysis.

After the initial coding stages, to comprehend patterns that emerged and get a stronger picture of the database, I needed to underlie and group key segments, overarch and identify subgroupings, and then conceptualized these categories including literature and theoretical structure of the study. As Saldaña (2013) claims, "Coding well requires that you read and reread and reread yet again as you code, recode, and recode yet again" (p. 39) until reaching intimate proficiency with its details. Thus, I rechecked the alignments of my research questions in this way, which provided me an advanced way to reorganize and reanalyze my data. With that respect, I used *Theoretical Coding* as my third coding method [referred to as *second cycle coding* by Saldaña *(*2013)]. Saldaña *suggests using second cycle coding method*, which refers to "central or code category" and "functions like an umbrella that covers and accounts for all other codes and categories formulated" (Saldaña, 2013, p. 223). Thus, I was able to condense all the products of analysis into a few words to be able to explain the overall sense of some similar codes and categories. For instance, as explaining 'Perceptions on Teacher Leadership', I explained the participants' insights separately into two sub-categories: (a) In the context of Informal Leadership Positions; and (b) In the context of Formal Leadership Positions. I used the theme constructions from one episode to compare to other episodes (e.g., as a teacher, mentor,

department chair, PD facilitator, etc.). By doing theme construction (categorizing the coded units), relationships between coded units were defined, and themes became exploratory/tentative constructions of understanding.

This process enabled me to (a) test themes for their relevance to the research questions, their exhaustiveness and explaining nature, and their conceptual congruence with other categories in the data (Merriam, 1998) and (b) develop a model/conceptual framework to illustrate how professional vision and identity and teacher leadership roles interact with each other over the leadership development process (see the last section in discussion-chapter V). In this process, I further constructed and delineated the final form of each theme and merged and subsumed them under other themes because these theoretical understandings were repetitively tested with further data collection and refinement. In addition, the theoretical framework of the study, *symbolic interactionism*, helped me interpret the participants' meaning making process and awareness level from their perceptions. Further, while analyzing the data, I aimed to develop a conceptual framework that accurately represented the data set and represented the connections among teacher leadership roles and characteristics considering professional vision and identity. In addition, from beginning to end of these coding and analysis processes, I also used analytic memos to help me in the preliminary analysis of my data in terms of accurately deciding on what to code and what to investigate further. As Saldaña (2013) explains the process of an analytic memo, it is to "document and reflect on: your coding process and code choices; how the process of inquiry is taking shape; and the emergent patterns, categories and subcategories, themes, and concepts in your data" (p. 32). The analytic memo as part of my data allowed me: (a) to see patterns that emerged and get a stronger picture of what I needed to focus on for coding and further investigation in the field, and (b) to connect my research questions to reflections that

arose during data collection and coding.

Validating the Accuracy of Findings: Establishing Trustworthiness

There are numerous criteria to assess the rigor of field research, including case studies. These criteria hinge on what authors refer to as the preferred model of discipline. Yin (2009), for instance, has adapted four criteria for use in case studies commonly used to assess the rigor of field research: *internal validity, construct validity, external validity, and reliability*. From the interpretivist approach, Mason (2002), argues that the canons of *validity, reliability, and generalizability* can be used in evaluating qualitative research; however, reconceptualizion of these standards are suggested to reflect the key issues of concern for interpretivist researchers (Carcary, 2009). In brief, many different approaches to evaluate qualitative research have been discussed in the literature. However, since *symbolic interactionism* used in this research lies within the interpretivist tradition, I will use the criteria that have been extensively used in qualitative research for validity and reliability: "credibility as an analog to internal validity, transferability as an analog to external validity, dependability as an analog to reliability, and confirmability as an analog to objectivity*"* (Lincoln & Guba, 1985, p. 76-77).

Credibility.

To establish credibility, I utilized the following techniques: purposeful sampling, prolonged engagement, persistent observation, triangulation, peer debriefing, member checking, and negative cases. Below I briefly described the techniques to address the specific concerns for credibility in qualitative research.

Triangulation/Crystallization. Due to its multi-perspective sources and nature, Richardson (2000) and Denzin and Lincoln (2005) describe triangulation as *crystallization*, which is triangulating data from multiple sources. According to Richardson, "[We] do not

triangulate; we crystallize. We recognized that there are far more than three sides from which to approach the world…Crystals are prisms that reflect externalities and refract within themselves, creating different colors, patterns, and arrays casting off in different directions" (p. 934). However, Merriam (2009) highlights, "[From] interpretive-constructivist perspective, triangulation remains a principal strategy to ensure for validity and reliability" (p. 216). The term *triangulation* will be used in this study.

Patton (2002) stated that multiple methods of data collection allow researchers to observe if the results from different methods lead to similar findings about the phenomena being examined. Triangulation also helps researchers to clarify meanings, verify the repeatability of an observation and/or interpretation. In that aspect, I utilized these dual processes along with Patton's (2002) fundamental credibility criteria:

- *triangulation of methods* (i.e., interviews and documents/archival data),
- *triangulation of sources* (i.e., analytic memos, reflection narratives, online discussions, email correspondence, curriculum artifacts of PD conducted by I-LEAD and teacher driven professional development conducted by MTFs),
- *triangulation of analysis* (three coding methods: In Vivo, Thematic Analysis, and Theoretical Coding) for the purpose of achieving trustworthiness of the research study.

I continued this process until all the data were examined and patterns emerged from the data that were meaningful and were able to be well articulated and substantiated. Thus, I was able to check out the consistency of findings generated by different data collection methods and different data sources within the same method and to interpret the data with multiple analysis techniques and perspectives. By doing this, I was able to see if findings from different sources led me in the same direction. Furthermore, this process made me feel more comfortable and

confident about the credibility of my research findings (Lincoln & Guba, 1985; Patton, 2002).

Member checking. Lincoln and Guba (1986) claim member checking is "the most critical technique for establishing credibility*"* (p. 314). In order to assure that participants' views and action have been interpreted fairly, I provided opportunities to my research participants for collaboration throughout the research process. To accomplish this I asked the participants to provide comments on summaries of my interpretations of their experiences (Hatch, 2002). However, the study participants did not provide any feedback.

Peer Debriefing. This technique offered me an opportunity to evaluate analytical comments from my peer(s) to see diverse views on the same data (or some particular excerpts) and enabled me to revisit my data and reevaluate my initial interpretations in the emerging methodological design. I utilized peer debriefing as a tool for purification and catharsis. Lincoln and Guba (1986) highlighted the benefit of peer debriefing, which is "clearing the mind of emotions and feelings that may be clouding good judgment or preventing emergence of sensible next steps" (p. 308).

Negative cases. Lincoln and Guba (1985) consider negative case analysis as a "process of revising hypothesis with hindsight" (p. 309). The purpose of the activity is constantly to refine conclusions until they account for all known cases without exceptions. Thus, I applied negative case analysis as an activity to help me refine working hypotheses. While performing negative case analysis, I checked and rechecked the data to see if all instances could fit within the emerging categories. In defining what makes a negative circumstance in MTFs' evolving leadership skills, I examined the unique differences that created outliers. New categories emerged, and I modified the categories to account for the new data.

Transferability.

According to Lincoln and Guba (1985), transferability of a study is accomplished via thick description, purposeful participant selection, and multiple data sources. This allows readers to determine the amount of transferability that exists between the presented study and other cases. As Patton (2002) asserts, thick description refers to a highly descriptive, detailed presentation of the findings with adequate evidence from multiple sources of data. To accomplish *thick description*, I presented a rich and detailed account of my analysis and interpretation, drawing on an extensive data collection, multiple data sources, and purposeful sampling along with typical sampling as a sub method of sampling. To maximize transferability, typical sampling allowed the findings of my study to be useful in similar situations. According to Wolcott (2005), "[Every] case is, in certain aspects, like all other cases, like some other cases, and like no other case" (p. 167).

Dependability.

Findings are considered dependable if the results are consistent with data collected. As Merriam (2009) emphasizes, "[Replication] of a qualitative study will not yield the same results… Several interpretations of the same data can be made… So if the findings of a study are consistent with the data presented, the study can be considered dependable" (p. 222). In my study, I established this via member check, peer debriefing, triangulation, and thick description.

Confirmability.

According to Lincoln and Guba (1985), confirmability refers to delivering necessary evidence to show that findings are logical regarding the context, time, and data collection. In my study, I produced a data reduction chart in the coding and interpretation process. Qualitative research is unique by virtue of its design; and one description cannot possibly account for all

experiences (Krathwohl, 2004). Thus, in addition to consulting literature to support my interpretations, I heavily relied on direct excerpts from the raw data as well to allow the individual reader to shape his/her own general beliefs and understandings as discovered through the personal interpretation of the research results (Willis, 2007).

Methods of Representation to Judge the Quality of the Case Study Design

Qualitative research studies present insights and conclusions to provide benefits to practitioners, researchers, or simple citizen. As Creswell (2013) claims, the presentation of data, "reflects the data analysis steps, and it varies from narration in narrative to tabled statements, meanings, and description" (p. 200). Qualitative case studies, "Do not attempt to simplify what cannot be simplified. Thus, it is precisely because case study includes paradoxes and acknowledges that there are no simple answers" (Shields, 2007, p. 13). A researcher, however, has a unique stance and assumptions that reflect on the study to address different questions. As Merriam states, "The researcher is the primary instrument of data collection and analysis", and "the case study has basically been faulted for its lack of representativeness" (p. 52) that is associated to the bias issue, subjectivity of the researcher. Thus, to conduct the investigation and data presentation in an ethical manner, the researcher needs to consider evaluation criteria, including but not limited to validity and reliability (Yin, 2008; Merriam, 2009). Below I provide a brief description of the roles that I took on while conducting and analyzing this qualitative case study.

Role of the Researcher

As a qualitative researcher, I deem that the world cannot be limited to unbiased meanings. Thus, it is critical that the researcher consider his/her interaction with the context and

participants in different forms and with varying degrees while studying things in educational settings to develop an understanding of the nested relationships.

I approached this dissertation study with previous experience as a teacher, who was about to be a teacher leader and as a graduate research assistant (GRA) with experience with the I-LEAD leadership training program. My interest in conducting this research study began by being involved in the data collection process from beginning of the I-LEAD project. While helping the research team via data collection (i.e., interviews, observation, taking field notes and analytic notes on collected data), I submersed myself in the research setting as an onlooker observer. Patton (2002) described an onlooker observer as one who completely separates himself from the research settings as a spectator does. My engagement in these settings allowed me to hear, see, and begin to experience reality as participants do (Marshall & Rossman, 1989). Nevertheless, I made sure that my involvement of the I-LEAD project, as a GRA before this proposed study did not affect my data collection and interpretation. I was careful to document interpretation of data obtained in the research settings. To accomplish this, as I explained in the previous section, I relied on validity and reliability criteria of the study. I also used analytic memos with the purpose of providing an immediate record of my own reactions to, feelings about, and opinions of the research process to be discussed with dissertation committee members. During the time I have been involved in data collection under the I-LEAD IRB thus the archival data that I used covered under their IRB.

Since conflict of interest is a significant consideration between the researcher, the participants, and their own scholarly responsibilities, before beginning further data collection (i.e., interviews with the MTFs), I outlined the description of my roles and responsibilities, as researcher, and that of participants in the consent form (see Appendix). Being cognizant that the

gathering of credible data is contingent on participants' confidence in the researcher, building and maintaining trust with the research participants will be my main objective in the course of the study (Lincoln & Guba, 1985). Due to my involvement with the participants over almost three years, I had established trust with each participant. Continuing that trust, I assured the participants that their confidence would not to be used against them and anonymity was honored. They had input, and actually influenced the research process and the data collected and findings of the study will in no way affect the participants' leadership trajectory.

I, as a researcher, conducted this research study with the ultimate consideration for research ethics by respecting the participants and the elucidated research process.

4 RESULTS

Teacher Leadership Trajectory in Conjunction with Professional Vision and Identity

The purpose of the study was to examine experienced physics and chemistry high school teachers' perceptions of their leadership roles and characteristics. The study aims to identify the high school teachers' professional vision and identity in a leadership context during their participation in a leadership development training program and teacher-driven professional development program (TDPD) that they was facilitated for K-12 teachers.

To understand the influence and interaction of the aforementioned concepts, the participants' perceptions and conceptualizations were used. The participants' perceptions and conceptualizations were expected to reflect their beliefs and interpretations of their teacher leadership trajectory, which ultimately influenced their teaching skills. To achieve this purpose of the study, data was generated from semi-structured interviews, archival data of I-LEAD (curriculum artifacts of the I-LEAD professional development (PD) plans, interviews with the study participants (MTFs), video recordings of professional development sessions along with transcripts of the I-LEAD PDs from the first year through the summer 2014, online discussion threads, emails, and reflective narratives), and curriculum artifacts of the PD plans of three MTFs were used to train other teachers in spring/summer 2014. The entire data set helped to address each of the research questions.

The overarching research question was an exploration of the MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development opportunities as they evolved from teachers into teacher leaders. The question had three sub-questions for clarity. This chapter is organized around seven sections. Sections one, two, three, four and six respond to the first sub-question to show the

MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through their participation in an I-LEAD professional development leadership program. The sixth section addresses the second sub-question by demonstrating the MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development activities as they developed and facilitated TDPD for K-12 teachers. The seventh section focuses on the third sub-question and illustrates how professional vision and identity and teacher leadership roles/skills affect one another through their own leadership trajectories. These findings are represented in accounts that function to uncover each study participants', MTFs', leadership journey plot.

Leadership Waves Across Teaching: Teacher as a Leader.

The study encompassed evolving teacher leaders: three Master Teaching Fellows (MTFs) (John, Natalie, and Ashley), one male physics teacher (John), and two female chemistry teachers (Ashley and Natalie). They began their teaching profession at different times, in different schools, in different states with different levels/grades of students and with a different level of pedagogical and content knowledge. The average participant had 11 years of teaching experience at the secondary level. Prior to becoming a part of the five-year leadership development project called I-LEAD, the participants of the study were middle and high school science teachers in a metropolitan city in the southeastern United States. Their teaching experiences as lead teachers qualified them to be agents of change for their students and to other students. Thus, a thorough knowledge on the participants' instructional practices and the level of their effectiveness in teaching helped to understand their progressive leadership practices. Data generated from individual interviews and archival data of I-LEAD illustrated that they were not traditional teachers - they used reform-based instructional practices to enrich their teaching and learning

activities. They were aware that the path to leadership began by becoming an exemplary and an innovative teacher. The narratives below illustrate how they challenged common teaching practices and sought to become innovative educators, visionaries, and lead teachers.

John: "Constant Revision from Ground up Perspective".

John was a high school physics teacher with 13 years of teaching experience with several certifications, including T-5 Masters Leadership, T-6 EdS Leadership, and AP Physics Certified. He taught honors and AP Physics courses. He was also a co-sponsor for National Honor Society. A combination of his experiences as a student (Bachelor of Science in Science Education), student teacher, and a former department chair contributed extensively to his teaching career. As a result, he was confident in his content and pedagogical content knowledge. During the discussion in the I-LEAD PD meetings, he explicitly provided examples to support his experiences.

John, as an experienced physics teacher and a vocal person, made comments about the issues in the context of physics. In the meeting in the summer workshop week of 2012, he initiated a discussion to elaborate the argument consisting of topics related to physics. His comments exhibited his confidence on his content and pedagogical knowledge and also his competency as a teacher.

Out of all the experiences John gained in his classroom, John's most prominent characteristic was his self-confidence in teaching. John built a rapport with his students by being honest and by being a good role model. He was critical of established school norms. For example, he thought it was odd that teachers asked students to behave and think in a certain way when the teachers themselves were not willing to behave and think in that way. For example, he stated,

> [If] you're not comfortable in doing that, then it's really hypocritical to ask kids to do something and then just play it off... I mean, *I'm asking you to, so you need to do it, when I'm not really showing you that.*

This brief narrative, gives an overall view of John's position about pushing the status quo. The same sentiments are expressed in other dialogues as well. In another meeting during the summer workshop, John was explicit about his beliefs about his student-driven teaching methods based on the students' feedback:

> [A]t least the level that I teach, I don't see what's not working. I mean, I feel like kids get a lot out of my class, I feel like people come back and say, *Hey, I learned a lot*. I want to be an engineer now because the class opened a whole new world for me.

Not only did John challenge his students and his staff with self-proclaimed innovative practices, he refused to follow traditional methods of teaching. At the same summer session, he argued that teaching is actually a way to reduce the stress in students. In an interview from archival data in February 2014, he gave a brief explanation of his teaching style, which was far from the traditional teacher-centered methods he witnessed in his school. He said,

> I do not value homework, physics concepts, vocabulary, or typical teaching or assessment things. Rather, cognitive learning and problem solving is important; pedagogy needs to be creative; using diverse teaching methods to help kids to see [the topic] from different angles; and how they apply knowledge into different situation so that they know solve the problems of real life.

In another effort to push his teaching practices, John made thought provoking challenges to students, which he called "bypass[ing] the traditional content." He believed that students learned better when asked how and why questions. He also believed that qualitative questions

brought about better answers and initiated quality discussions. John said, "[M]ost of the discussions in physics is around problem-solving, which leads to students defaulting to smart kids in class." He claimed that classroom discussions increased the quality of learning and also helped teachers assess their students' knowledge. He stated, "You don't explore the content with the discussion; you explore students' ideas about the content." He was aware of the importance of discourse patterns in discussions, but he also criticized himself in a reflective manner by stating, "I need to be more deliberate in how I address student responses." Although he claimed that classroom discussions were a great method of teaching and learning, he conducted classroom discussions only once in a week. He defined his students as super comfortable when filling in the blanks and when they get correct answers without getting any stress. However, he expressed that getting his students, including the brightest ones, to value talking as a way to develop their thinking was difficult. His biggest challenge with his students was to make them give elaborate explanations. He stated "The kids I have don't like elaborating, don't like constructing knowledge from others; getting them to bounce ideas off of each other is rare."

In addition to stressing weekly group discussions, he also gave equal priority to both small ideas and big ideas. He objected to focusing on big ideas alone: "I think there's some truth there that we could emphasize all the big ideas but if we don't get any of the smaller ideas, we didn't move the criteria." He was worried about teaching from that perspective, "[A]s kids come in every day and say, *I don't know what specifically I've learned. I just know that everything fits together*." Here, his concern was helping students understand where *Big Ideas* come from; that is why he led his students to make connections between prior and new knowledge and transfer them to other areas. He also stated, "I want kids to be able to transfer what they learned here to a new situation… come up with a new model."

According to John, "science is everywhere and hence it should be easily connected and related with the facts of life." So, undesired beliefs like science is boring and/or scary to learn could be prevented. In the interview from archival data in May 2014, John elaborated his perspective:

> I see in my every day experience, these concepts that we talk about aren't just science class or vocabulary, they are integrated in my life, they are in the universe, they are in everything that I do and seeing that relevance where most people just see mundane. When most people just see life, and a science book, but they don't see them together. I think that's important for people. How do you do that? I think you have to make it relevant, and make it interesting.

John was both honest and reflective about his teaching practices and often made revisions to his teaching practices in order to enhance them. He shared both his good practices and some areas in which he needed improvement. In essence, he advocated for reform-based instructional strategies (i.e., student-centered classrooms, discussion led classes, and making connections from discreet bodies of knowledge to real-world applicable skills) and had great confidence in his teaching ability. In December 2012 session, he also emphasized that he knows well how to manage a classroom. When faced with students who pose disciplinary issues to teachers, he asserted that he made sure to let the students know that he was in charge of his class in a non-threatening manner. He believed that teachers should lead students. John also wanted to change or eliminate teaching strategies that he felt were not useful in helping students learn. He criticized himself, especially, when implementing traditional methods even rarely, and stated, "I don't like my pedagogy for this style. I mean, me personally, I think that the best thing I can do for them is to teach them that it's constantly reworking things." John identified himself as a

continuous learner who was still in the process of improving his pedagogy as a teacher. He stated, “There are ways that you can reach kids better.” Further, he prioritized his focus on learning about students and their assets in order to continuously help the students improve their skills. Rather than being a person who addressed only the weak areas in students, he wanted to be a change agent in and the reason for changes in the way his students thought about science. He stated,

> [N]o one really makes a change in your life. You make a change in your life. So if you can teach them a skill that is useful to them, I don't think focusing on their weaknesses at first is probably going to work unless it's a huge—obvious weakness like they use profanity in front of the classroom.

Above all, John also assessed educational issues from a wider perspective, which is different than the way ordinary teachers approach these issues. He believed that he could fix issues (e.g., making science relevant to everyday life) in a classroom as a teacher, but as a teacher leader, he demanded to have a voice in decision-making at the school, district and at the state levels. He justified his comment using an example on the preparation and implementation of reform-based ideas such as Next Generation Science Standards (NGSS):

> [NGSS] is a great idea...It’s really not [that] kids don’t understand mathematics or kids don’t understand algebra... That’s my fear. I just feel like we’re rearranging cups trying to fix a problem that we can’t fix within the walls of the school... we can’t fix in education because it’s a societal problem. I mean apathy is the problem we’re fighting.

John’s concern here was that a majority of teachers do not have a ground-up perspective when approaching new things, like new standards. Thus, to him, it seemed hard to meet other teachers *on the same page* to develop better/more reform-based instructional strategies at all points. He

stated, "[T]hey know all that stuff like backwards and forwards, but they know it from this perspective rather than a ground-up perspective, and your teaching is from ground-up. So that's my concern." In summary, John felt that change was necessary to alter students' perception of science. In order to do this, he felt that teacher's instructional methods had to be changed in a way that focused on the students. In the following section, I will share narratives from another program participant, whose views mirrored John's, in that teaching must center on students.

Natalie: "Nucleation of Change".

Natalie was a high school chemistry teacher with eight years of teaching experience. She had a Bachelor of Science in Biochemistry and a Master of Arts in Teaching in Chemistry Education. She taught honors chemistry and general chemistry to sophomores. As a young teacher, she described herself as an outgoing and a passionate educator who liked to interact with her students. In an interview from archival data with her in October 2013, she identified how her personal attributes influenced her teaching. She stated,

> I'm very hyper-energetic and I think that probably adds to my entertainment value to [students], because you know I'm funny to them. I got a note from them today that they want a quote from me for the yearbook because I'm funny... I am pretty outgoing person, and I think I am a person that the students feel comfortable coming and talking about, you know, things, and about asking me questions. So, they can feel they can approach me because I think it is important.

Natalie emphasized that creating a positive learning environment was a very crucial element in teaching. According to Natalie, this approach helped both teachers' practices and students' learning in a positive manner. She also explained that providing the students with options to have them be responsible for their learning and making common decisions must be

another key element in quality teaching. This approach also helped her to foster collaborative effort and team building between herself and her students. This seemed to encourage her students to express their ideas, beliefs, and respect for others' thoughts, freely. This also helped the students to feel more responsible and privileged in a classroom learning community. Natalie said,

> I'm very natural with the kids... I treat them different than most teachers. I think most teachers you know, more dictate to them *you do this, you do that* and I take more of a collaborative approach and I let them vote on things even though I already have my own idea of how this is going to go.

As stated in her brief narrative, Natalie thought that it was important to understand the child as an individual first. In her eyes, this is what made her a good teacher. Natalie was able to understand her students' knowledge, skills and emotional needs. She stated that if a teacher were not aware of his/her students' learning readiness, then even the most effective teaching strategy would not work. In a teaching and learning process, she considered that students' sentimental values are significant for touching students' feeling (their emotions) and their world. Otherwise, it becomes hard to connect students with knowledge and assist them to tap into their own ways of learning, as she advocated. She insisted that it is better to make the students ready to learn than wasting time in pushing them firmly to understand the concepts.

> I usually can tell when they're stressed out and I'll be like *what's wrong, what's going on today* and they tell me *oh, miss so-and-so has got a project and we have a test in this class* and so you know, I just try to understand how they are feeling and why they are feeling in that way… and what can I do to try to ease that tension or make them feel better.

In addition to her compassionate nature, Natalie utilized other highly effective teaching methods. Although she was the least experienced teacher among other MTFs, she tried using multiple effective strategies, including making students draw pictures/schematics, share, discuss, and analyze their own ideas and group ideas. In the summer 2012 workshop, she stated, "[T]o me it was like something that holds them accountable to keep them on task, keep them engaged, to keep them in conversation and to help me manage that situation." To help students develop deeper conceptual understanding of the material, she made them interact with each other about their ideas initially rather than passively reading and listening. She believed that it was central to keep them experiencing and interacting with each other, their ideas on the first hand rather than passively reading and listening. In this process, she defined herself as a *guide*, which helped her students to come up with their own ideas. She refused paraphrasing her students because she believed that it is a kind of "mocking them." She also explained why students needed more guidance in fulfilling their ideas:

> I feel like I guide more than initially... they're resistant the whole term... Because they've never had a teacher that's listened to their idea, internalized it and then tried to re-say it back to them and, I mean, I think that you probably kind of guide with questions more initially and then as it goes along.

Keeping with her beliefs that collaborative learning worked best for her students, Natalie also gave priority to "peer learning" In the Quality Talk workshop, a part of workshop series embedded in I-LEAD. In June 2013, Natalie expressed that students naturally like talking to each other, think analytically about system, and connect to chemistry outside the classroom. According to Natalie, a learning process should be done dialogically. A free expression of ideas along with a discourse would provide students with a platform to learn from peers. She stated,

"When you are involved in a discourse … it provides you an unique opportunity for students to learn from each other and helps them to develop deep conceptual understanding." She continued her discussion on benefits of discourse, which "enable students to interact each others' ideas and then connect to the big ideas." She also mentioned the results of Physics Education Technology [PhET] simulation [she designed and delivered guided inquiry workshop to all students in her school] and its influence on developing a model that increased students' discussions and discourse. This simulation helped her to understand the students' level of understanding. The only challenge that she faced in that workshop was time management during students' talk; in which, she consulted in an email to the I-LEAD team for their feedback to improve her management strategies in classroom discussion: "I've got to figure out how to balance time constraints with giving the students a voice. I'd love to watch part of the video with you and get your feedback as I continue working on this." [Email exchange-2012]

In addition to peer discourse, Natalie also felt it was important to tap into as many students as she could, which countered the reservations and self-doubt she had in dealing with classroom management. As a milestone in her teaching journey, she gave a workshop (PASCO science workshop, 2012) for all students in her school. During the summer workshop week of 2012, she shared her experience on this workshop. She felt accomplished in classroom management with the use of hands-on activities and small group discussions in a big student population. The use of classroom management techniques increased her self-confidence and strategic thinking in dealing with more high school students. These techniques also helped her in terms of keeping the students in an active learning process. She enthusiastically expressed,

> I felt like it was beneficial because they all had ownership in it. They all took part in it and created together. They got to talk about their ideas, you know, as a small group and

> as a class... what I thought about was great because it to me that was one strategy that helped me with 32 kids in it.

As a growing and promising teacher leader, Natalie had always been interested in new ideas to apply in her classroom. I-LEAD team always encouraged her to keep searching and bringing new ideas for use in both her classroom and in the group of MTFs. In her emails to the project team in January 2013, she expressed her interest in innovative ideas to transfer some effective activities for her students. She consulted Brad and Gary about a particular topic: abductive reasoning. She said,

> I was working on... It is written in terms of the learning cycle. Could I modify the activity so that it fits more of an abductive reasoning flow? Or do I need to keep looking for something else? Tell me what you think.

As exemplified from her correspondences to her peers and her constant means of pushing her self-proclaimed barriers, Natalie was an evolving teacher leader. Natalie was open and had been looking for innovative and effective ideas to improve her teaching and learning strategies. She firmly believed that collaborative team works would always create a dynamic difference in teaching and learning practices. She was appreciated for exchanging ideas with the project team and other MTFs, specifically with John. Natalie also believed that without collaborative effort, evolution for teachers and teacher leaders might not be possible. In the summer workshop (2012), a discussion was held on NGSS and helping colleagues to get and adapt to the new ideas. During this discussion, she was very curious to know about the process involved in releasing the new standards by the states (i.e., NGSS); she also asked several questions to the I-LEAD team members about it, and continued,

> I think it will improve everybody's teaching if they focus on the standards. That's the thing, the buy-in there, you know. If I go and I look at these things and I restructure my stuff... But I think it's getting everybody to do that or not; it needs to be a collaborative effort.

Her opinion on collaborative effort illustrated her openness to learn new pedagogical aspects and helping others to improve their teaching. Her attitude towards working together and being beneficial to both her students and colleagues exhibited her leadership potential. She desired to see herself as a "nucleation point of change", as she said in March workshop 2012. She also stated,

> I think that National Board Certification will help me... analyze myself as a teacher... help me go to a different level of analyzing myself . . . and the impact that I have. And it kind of reminded me of –we did it at some point [in her MAT program] – where we took the unit [she had developed], and we analyzed the assessments and...It could help me be better at that [impact on students and others learning]. And, I think that it's something that would help me to analyze myself in maybe a way that I haven't done, or maybe that I don't do often enough. And, um, I talked about wanting to be; I called it a 'nucleation point' for change.

Natalie, as a lead chemistry leader, also handled all supplies, chemicals, and equipment purchases and disposals that were needed for her department. In addition to her MAT studies, National Board Certification, and her reflective approach on her professional practices seemed to enhance her teaching philosophy, beliefs on her leadership (professional identity- PI), and understanding the leadership practices (professional vision- PV).

Ashley: "Holding Students' Accountable".

Ashley worked as a high school chemistry teacher . She had 13 years of teaching experience. Additionally, she also had several certifications (i.e., T-6 Specialist Certification in Broad-field Science and in-field Gifted Certification). Her educational qualifications was also impressive, with a Bachelor of Science in Life Science Education and a Doctoral study in Science Education. Further, she held a formal leadership position as a science department chair at her school. She was originally from another state, and moved to her current state of residence without any background information on the schools in this state. She started teaching Biology and Human Anatomy and Physiology. Though her background was in Life Science Education, she had a minor in Chemistry and hence stated that she wanted to teach Chemistry.

Much like the other participants, Ashley wanted to challenge the teaching methods she witnessed in her school. With her educational background and 13 years of experience in science teaching, Ashley always encouraged her students to leave their *comfort-zone* by engaging them in reading and listening. She also encouraged them to be active learners and be responsible for their own learning. She maintained that her students had shared accountability in her classroom. She also ensured that she got the full attention of her students and helped them to conquer the fear of learning science. She said,

> I think they would say that I am fun, kind of joke around a lot in my room… I'm sarcastic and can kind of poke fun at them and they can poke fun at me. I hold them *accountable*, that they have to do a good job on their work and if they don't they have to come in and re-do it. So there's some accountability there, but I make it fair, so that if they think they can be successful in science, I don't penalize them for things that are petty, like turning something in later that day instead of the day it is due.

She further believed that a teacher should be an effective guide. Much like Natalie, she wanted to create intellectual exchange between students' ideas and implement appropriate and multiple teaching strategies to add/develop their learning skills. She strived to build autonomy and empowered the learners to ask and seek the answers to their own questions that were beyond teacher-centered instructional strategies. According to her, "Students controlled the topic because they asked the questions about making sense of what they didn't understand." At this point, she touched on the importance of discussions in a classroom. To her, discussion was an instructional strategy that a teacher adds to her repertoire of skills while dealing with students' questions. During a discussion in the summer workshop of 2012 on the pros and cons of small group versus large group discussions, she stated, "I need to do a little bit of both; small groups provide willingness to risk-taking... large-group discussions [are good] if students are allowed to bring in resources." She also underlined what research says; that is, small groups lead to larger gains in understanding the concepts and ideas. Her dissertation topic was also related to how students learn through the argumentation process. She was particularly looking at:

> [W]hat was discussed during the lab and in their written arguments to see: (a) if there are crises over areas, and (b) if they are actually learning from stuff they see in their group; and if so how, are they taking it from one specific person, are they taking it from when they interact with another group. So what about it are they learning and how is that trying to come about.

Much like the other research participants (i.e., John), Ashley thought it was important to explore deeply the "Big Idea" concept. In the summer workshop series in 2012, "Big Ideas" was quite a hot topic for discussion and the project team periodically underlined that too. The reason behind the importance of big ideas was that they were very significant in understanding science

activities and they merge into wide ranges of scientific facts so that they can be generalized and taught in diverse methods. When Brad asked Ashley about connecting the Big Ideas into their level of curriculum, she confidently stressed a deductive way to get up to the Big Ideas, which was similar to John's view about the topic:

> To me these crosscutting concepts are almost a way to get to the Big Ideas. Such as those being the overarching thing and then the Big Ideas. I'm thinking more of Big Ideas and then this is the way that you develop understanding of those Big Ideas; just by examining patterns and building models and… looking at proportions.

Not only was Ashley confidant in the manner in which she forced students to work through the curriculum through Big Ideas, she was confident in this manner of teaching and learning. Her self-confidence and self-efficacy on her teaching was quite visible in the professional development meetings delivered by the I-LEAD team and during the interviews. Ashley's experience and confidence seemed to help her to restructure the course of her instructional design when she felt that her students were getting disconnected. She defined herself as a creative mind and she also mentioned that she was open to making changes to her instructional strategies whenever necessary. In an interview from archival data in February 2013, she stated, "[A]s a teacher when I'm teaching in my classroom, changing things up mid-class was no big deal, so, *Oh, this wasn't working, everybody stop*! *Let's try this instead*." This statement exhibited her confidence in her content and pedagogical knowledge as well as her leadership style. Immediately after that, she reflected on her teaching practices and declared what she did not advocate the use of mundane teaching practices. She stated, "And, so, I'm not a person who's stuck in a rut doing the same thing over and over again," and added, "which is good and bad, I mean there's benefits and drawbacks to both of that."

In fact, her assertive approach on her teaching skills improved during these meetings, as she expressed, "[T]he skill that I've developed the most in the past year is developing relationships with people and it's come through in the Noyce program [I-LEAD] and learning about what makes good science teaching." This also confirmed that one of the goals of the I-LEAD leadership training program had been attaining its objectives. However, Ashley's leadership activities were also quite significant even before attending the program. She explained her eligibility and volunteer contributions out of her classroom:

> I probably started seeing myself as a teacher leader before I became department chair, for the past couple of years I've started a lot of committees and volunteered to like, spearhead things in our school. So if they like needed someone to do an intervention and serve on the intervention committee for science, I took on that role, um so I knew that I had things that I wanted to contribute, there are things that I know that I do really well I can give to other people, and I can also pull from them and other strengths.

As a teacher, she had been taking roles beyond her classroom related to instructional settings [i.e., instructional leadership, etc.] before participating to the I-LEAD and having a title as a department chair. Her desire to become a leader started before she had an official leadership title; thus, she was prepared to become a reflective and intentional practitioner in the way she viewed her teaching and students' learning.

Overview.

The data above illustrated all MTFs had strong pedagogical content knowledge background in their areas of expertise. They were good at classroom management and relationships with students, and utilized student-centered strategies with multiple effective methods (e.g., inquiry, discussions, discourse, argumentation, PhET simulations, etc.). In

addition to their similar teaching philosophies, each of these MTFs had also other instructional priorities. For example, John's focus was on teaching with real-life connections, qualitative questions, learning and improving students' assets, and changing teachers' perspectives towards reformed-based instructional strategies. Natalie focused on providing students with options to have them responsible, promoting peer learning via social interactions, understanding students' skills and emotional readiness, and suggesting innovative ideas beyond her classroom. She believed effective teaching inside and outside of her classroom could be carried out through collaborative teaming efforts. She saw her colleagues as extensions of her professional tool-kit. One of Ashley's salient teaching philosophies that varied from the other MTFs was her research-based approach, which came from her extensive graduate study as a doctoral student in science education and volunteer contributions outside of her classroom.

The MTFs greatly demonstrated their in-class leadership competence. For example, they lead their colleagues in implementing reformative, innovative, and collaborative teaching methodologies, as teachers in their classroom. They were change agents for how classroom instruction looked for secondary students. They challenged the idea that secondary science courses had to be teacher driven and forced their students to think of science in a more real-world setting. However, since teacher leadership requires being able to take both in and out of the classroom leadership roles, it is important for us to continue the exploration of secondary science teachers leadership attributes in their out-of-classroom role(s). The next section will explore leadership roles that exist outside of the four laboratory walls, such as mentoring practices. How teacher leaders extend their leadership capabilities puts another significant layer on their leadership performance, professional vision, and identity.

Role of Mentoring Practices in Evolving Teacher Leadership Competence Accompanied by Professional Vision and Professional Identity.

From the narratives highlighted above, it was observed that the MTFs (John, Natalie and Ashley) were far from being ordinary teachers who were stuck to the traditional teaching methods. The data also signified their quality teaching practices. Apart from being graduate degree holders, experienced teachers, and former/current department heads, they were also the participants of the five-year leadership training program as mentors.

In I-LEAD PD meetings, mentoring, coaching, and advising novice teachers were the highly disputed topics considered for discussion. The project team brought mentoring to the table for discussion, considering all the factors that influenced teaching fellows (TF), student teachers (ST), and other teachers at their schools. During the discussion, the conversation revolved around: (a) how mentoring had been going, (b) how it had been progressing, and (c) what could be done to help if their practices did not go well. The main questions that were asked to the group of MTFs included, "How do we mentor our mentees? What role of mentoring comes into play with leadership?" The MTFs' insights on these big ideas and their experiences illustrated their role in mentoring practices. Their ability to mentor was also amplified by their leadership competence, professional vision and identity, or vice versa. However, numerous arguments on similar and diverse areas were also observed within the I-LEAD project among the MTFs. Below I illustrate the various views the MTFs had on the role of mentoring practices.

John: "Tacit understanding of what's going on pedagogically".

Mentoring was a highly contentious topic of conversation for the MTFs. Some viewed it as a personally rewarding experience for both the mentor and mentee and others felt that it disrupted the natural order and safe feeling of their classroom. John was an MTF participant that

was concerned about the role of mentoring in a real classroom setting, and hence he joined the conversation as all MTFs shared their struggles in the October workshop in 2012. John claimed, "high school students are hyper-critical" about student teacher(s) [ST]. He also added that these student teachers kept complaining about the same issue. He further argued that any improvement that may be needed in a STs through feedback is the students [high school students] responsibility, "[I]t is that their [the students'] job? I mean, is it a high school students' job to make a student teacher's life easy… I'm not saying that to be critical – that comes across as really critical." John also suggested that although mentor leaders should guide novice teachers through the introductory phase of student teaching, they also take responsibility of students' learning and achievement through state and district testing mandates. As mentors, he was reminded that they "still are held responsible for the [standardized test] results." When he saw the students' feedback issue from another angle, he asserted that students' feedback should be given importance. He continued, "But you have to be careful too because, some of the feedback that I've got is, *He's [ST] trying to be you* [John]. And then it comes across as played." John also thought, "[T]hey see… I mean, high school students see right through that." When John was asked about the manner he handled students' feedback, he responded, "That's what I'm saying. I don't know." However, a year later, in the April workshop, he was quite clear about the students' role in providing feedback to the STs. He claimed, "I definitely think it's their role to ask." However, he wanted to tell the students to be careful on their feedback. He believed that they can be cruel, but should be fair on their comments. Nonetheless, it was not easy to handle students' words; he stated, "How in the world do you say that?"

In addition to student feedback to STs, John also struggled with the right way to give feedback to his ST. John stated that his ST took too much time to present a topic, which was a

perennial issue that John was struggling with guiding his ST's teaching style from traditional way to innovative ways. For example, for John's ST it took five days to present a topic for that would have taken him just two days. The ST's lectures were too long and route, which went against everything John had worked up to in his class. As a result of length of the ST's lectures, John believed that this method was, "[B]oring for me, and so I know it's boring to 17 year olds." John knew that it was a natural and challenging process for teacher candidates, "[H]e's a new teacher. He's never done this before. He doesn't know how long things are going to take. Nor does he know how long they should take." When he asked the ST, "how do you think the day went?," his ST answered, "'I think it went okay." However, John could not say that, "I don't think it went that good." When John was asked whether he could co-plan with his ST, he reacted,

> That's difficult because I've never done it before. And so I was just voicing my concern over … This is a natural concern, I don't think it's an unnatural concern. I don't think he's doing a terrible job. I think he's doing what every young teacher does who comes out of college being lectured to all of the time, where they talk all period, and they don't really intend to, I think. [October workshop 2012]

John had a hard time allowing his ST to proceed with his own way because as he said, "[T]his is my first student teacher, so learning to let go was difficult." Moreover, John believed that his job became harder, particularly, when his ST made some mistakes while delivering the content and formulas. John asked other MTFs and the project leaders, "Do I correct him, or do let a student correct him?' What's worse?... , it's harder than I thought it would be." John had boldness in his pedagogy and he expected his STs to teach like him because he believed in his pedagogical content knowledge. He wanted his ST to teach like him in terms of challenging students' conceptual understanding. John's issues with his STs were resolved by suggestions and feedback

by the I-LEAD community. The project leaders helped John accept his STs with both his shortcomings and strengths. The project leaders also explained that the STs might have content specific expertise, but, due to limited pedagogical experience, they found the situation quite challenging for John to handle. It is a "slow learning curve", as John said and Ashley also agreed. John began to see mentoring process with different views and he also began to accept his ST's strengths, ability, and capacity. He later argued,

> I had to get past the whole wanting him to be a perfect physics teacher. He's not going to be. He's not going to have confidence in front of the classroom. He has no experience whatsoever teaching teenagers... So it's crazy to think that someone's going to come in and be an awesome teacher... because when I describe my student teacher, I'm like, 'He's going to be a great physics teacher.' I can just tell; he is. Does he do everything well? No. But I didn't either, when I started.

Through the reflective process of John learning how to be a mentor, he also learned how to open up and make the mentoring relationship mutually beneficial. Later on, John shared his mentoring practices with his ST. In the workshop in January 2014, he stated. "[This challenging process] enabled me to stand back and assess what I do. It enabled me to be reflective, and focused me to ask, *Why wouldn't I have done that?* It was about me being a better leader." It is important to note here that he became more reflective as a result of his engagement with mentoring and involvement in the program.

Significantly, it was John, an experienced teacher and former department chair that accepted the internalization process of teaching and learning and accepted that in a profession, maturity is attained through practice and it takes time. This statement applied to both John and his ST in terms of learning mentoring strategies and in terms of applying good pedagogy,

respectively. Thus, John concluded that mentors should advise the methodologies with great patience, but without enforcing STs to go by only one way or their own mentor's way. It was observed by the project team that John's approach to his mentoring changed dramatically and rapidly. John highlighted, "if you want other teachers to teach like you, then you have to be a good mentor to other teachers.' and so, 'It's a process that everybody's gone through. And it's required." As evident in this statement, John's view on mentoring was quite different at the beginning of the project than towards the end. In the workshop in December 2012, Gary (a project leader) had asked John about the catalyst that drove him to get that *paradigm shift* of focusing on being a good mentor. John explained where that shift came from: "It's because of the realization that this is what's going to happen, and this is what needs to happen." He narrated the benefits of the discussion with other MTFs and the project team. He stated,

> I'm part of this program. I mean this part of the program is how to train new teachers... So, how do I need to look at this? It's kind of like a vision thing. Like, how do I need to look at this situation? Do I need to look at it as, you know, my typical teacher sense, which is someone's coming into my room and they're taking over my job.

He also elaborated his new way of thinking, which is encouraging STs to find their best teaching pedagogy, providing a platform for them to gain experience, and being an exemplary mentor-role model.

> If I want more people to teach like me and to have my mindset in teaching, then I've got to be a good mentor to other teachers. I can't just be a contractor in my room that does my thing. *No, that's, J that does that*. You know, you've got to be a good platform for that, and you've got to help other teachers realize – or new aspiring teachers – that, you know, you get to do it your way, so that's the nice part about teaching. When people ask me why

do you like teaching, because I can do everything my way.

John further asserted that he identified the heart of mentoring. He explained that he could see his ST, being from a good university with a strong content background and having a work experience from a good school, just needed to show his confidence in front of the class. John was well aware of the fact that confidence could be gained with actual teaching practices and realization of what works or what does not work. He also emphasized that he and all MTFs at the group are mentors and leaders and thus needed to elevate STs' practices. At this point, after John's realization-paradigm shift, he provided constructive feedback to his ST and felt accomplished when he saw addressing some key points from their conversation:

> We're talking after a lesson. I had addressed something about how he was struggling to draw a picture, uh, that I thought was really important for him to draw, a good visual of it. And so, I addressed it and said, *Hey, you might want to pre-prepare something on a PowerPoint slide or something, because I think you're spending too much time with your back to the students*. And so, it went better this time after he did it. I mean, that was the idea, was that this time, he would have done better. And so, I kind of asked him, like, how he felt about how that went and, um, he was just addressing that.

In fact, John's paradigm shift was also signified a month later in the November workshop in 2012. He was in the process of finding the best way to help himself in fixing his STs' areas of weakness. He stated, "I guess, an eye opening for me is stuff that I do that I don't realize that I do. And like, and I still don't even know how to really put my finger on it." John described his ST's learning curve as, "tacit understanding of what's going on pedagogically." Further, he began to explicitly address the functioning and ineffective points to his ST. He said, "I said this because of this, and I felt like that was more effective." This paradigm shift also demonstrated the growth in

his professional vision in terms of seeing differently his mentorship/leadership practices.

These excerpts illustrated the development of professional vision (his understanding the requirements of role of mentoring), identity (his professional self-concept based on mentoring practices), and leadership skills (building rapport with ST) through mentoring that occurred in the process over time. In the meeting in March, 2012 John emphasized the importance of the ongoing process of learning. He stated, "And we [all MTFs] are all learning as a group. When we sit down with new teachers, we are still learning, too." He further reported that the workshops within this project, "helps to hear what's going on with other people."

Natalie: "Helped her find that in herself... It was like magical".

Much like John, Natalie had to become reflective as a mentor and work through what her role was as a mentor teacher. Natalie, who had less experience as a teacher and a mentor, believed that mentoring should focus on STs strengths. In December 2012's workshop Natalie stated:

> [A]t first I got hung up on the teaching the way I want her [ST] to teach things, and then I kind of took a step back. And I was like, 'Okay, so maybe she's just good at things that I'm not, or maybe she has things about her that she can contribute to this classroom... I just gave her some tasks. I was like, 'Hey, we've got this thing. Can you try to find something for this?' And she super-blossomed from that point forward from the lab aspect. And I felt like, I found like her niche– that was her thing that she was really good at and that she could bring to the classroom. And I felt like once I found, like, helped her find that in herself, then she started to have more confidence, and because of that, she started to get more rapport with the students... when she builds a lot more confidence, and then they [students] listen to her more. It was, like, magical.

The reason behind Natalie's help to her [ST] was that the STs contribution to teaching would benefit both Natalie and the ST. Natalie argued that "kind of helped everybody in the end." Natalie believed the students were able to get the benefit of her and the benefit of her ST, which together could help, in their improvement of teaching. Natalie's ST had poor speaking skills in front of the classroom, including lack of tone of voice and instructional strategies to grab students' attention. This was the basis behind her mentoring model. Natalie also expressed, "That was a huge issue for her. And she doesn't like to yell. Um, something about her childhood, being yelled at."

There was a very significant idea embedded in excerpts above. Though Natalie had little experience, she was able to view the mentoring process from different angles. As a the mentor with the least experience, she was aware of the importance of exploring and focusing STs' strengths as a bridge to help develop better competencies. When Natalie allocated simple tasks to the STs, she observed that they were able to develop rapport with their students. Natalie's innovative approach to use the method of mentoring demonstrated the following: (a) new leadership style in which she respected and handled others' weaknesses logically-along with rationales and acting as a leader step-by-step, (b) her professional vision, as she was able to observe and notice the effectiveness of the strategies she applied, and (c) her professional identity based on her approach to professional self-concept using her characteristics and mentoring experiences. The following passage obviously elucidated her method of mentoring [professional vision] and the way she came up this model of practice [professional identity] by having good communication [leadership attribute]:

> I felt like at first, I was being narrow-minded about what I expected from her. I felt like I expected her to do things this certain way because that's the way I did things. And then I

was like, well maybe she can do things her own way... We just talked about, it was just like a pre-lesson, pre-observation, like, 'Hey, what are some things you want me to focus on? What are some things you feel like you're weak in or that might be a concern for this lesson?' That's all we really did.

Though Natalie was able to mentor effectively, she was least effective with the *pre-conferencing*. She was unable to provide good questions and appropriate suggestions to the ST so that s/he could reflect on her practices. Natalie further talked about her pre-teaching conference with her student teacher in the fall and she mentioned that she found herself very much unstructured. The questions asked by her ST made her realize that she should have asked those questions to herself before. She stated, "And I feel like she [the ST] didn't get everything out of it – that pre-conference – that she could have because I didn't ask the right questions." Even though Natalie had good leadership abilities, she was not able to ask effective questions. It was believed by her that her inability was due to her limited experience in mentoring. She criticized her mentoring process and explained that she did not do enough to help the ST in building rapport with students: "I think that she didn't – and it's partly my fault because I think I should have encouraged this more – that she didn't take the time to build the rapport with them that I have taken the time to build." Thus, "And like, she still doesn't know their names."

Much like the other MTFs, she documented the students' perceptions of the ST's effectiveness by collecting their feedback on the teaching practices of the ST. During the workshop in October 2012, Natalie explained her strategy to see what students' thought about the ST: "I've started asking them more direct questions, like, *Well, what is it that you're struggling with*?" Students replied, *she just talks too fast and she talks too quiet*." Natalie led her students in a way that they should give feedback to the ST on the basis of mutual respect, "[So],

again, I tell them, *You raise your hand and say*... You know, so, that's kind of how I've been trying to handle it." However, the study found that the students' feedback was a problematic subject among all MTFs, including this study's participants (i.e. Ashley and John).

Ashley: "Baby steps and to reiterate those over and over again".

Like the other MTFs, Ashley, who had years of teaching and mentoring experience, also shared her struggles with her mentee/student teacher (ST). She narrated that she was impatient in advising her ST. In an email correspondence and the I-LEAD PD discussions, Ashley shared her concerns about her mentee, ST, with other MTFs and the project team several times. She sought to find the best solution through brainstorming with the I-LEAD group. According to her, the mentee was very intelligent and she stated that the mentee definitely wanted to teach better. However, he struggled with the implementation of theoretical teaching strategies that fit his personality. He also had some difficulty in delivering the content both Ashley and he had been working on. Ashley was concerned about the way he approached theoretical ideas and the method he used to infuse them in his own teaching style. She was also concerned about the impact it might have on building positive relationship with students. To overcome these issues, she consulted a few times with Brad and Gary in an email [2012]. She explained that the students were frustrated with the ST and they did not feel that their voices were being heard. The students were not learning when he tried to provide them with instruction. Besides her students, her colleagues also did not want to help him through his first teaching experience. She continued,

> I've been struggling to try and come up with strategies to work with him when it seems like he thinks he already knows everything... The main issue and the main reason that I need some guidance is because as we've started preparing for next semester the other teachers have told me that they do not want to work with him... I hate that I'm losing

> some valuable collaboration and that he will not be able to benefit from the other teachers because of both personality issues and an inability to connect with students. Do you have suggestions or any kind of guidance that I might be able to use to continue growing him as a teacher while not losing some of the great things that I love about my coworkers? I feel like I've exhausted all of my resources and am at a point of major frustration.

The mentor/mentee relationship was problematic, because Ashley relied heavily on the collaborative spirit of her peers. In essence, Ashley expressed that she felt "stuck" with him and was not able to find a way to deal with this situation with the aid of her colleagues. She also shared that both her students and colleagues did not respect him. Related to this, she, like John, shared her struggle with paraphrasing students' insights on student surveys to evaluate the STs. Because she had a mentee ST that was stubborn, she had the most difficulty sharing the results of students' feedback. She was also worried that she could have made things even worse by trying to offer him suggestions in front of the class. In another email communication, Ashley shared the information on the initiatives she had taken to resolve the issue. She was open for suggestions that could possibly make the students feel less frustrated while ST was practicing with teaching and learning. She also asked for some suggestions that she might try first, such as, "Should we be doing more co-teaching or will that make things worse?"

Brad gave her some useful suggestions and those suggestions were having her ST (a) read and reflect on an article, which was about pre-service teacher's beliefs, and (b) videotape himself and reflect upon it from his own and then the students' perspective. Based on Brad's experiences as a faculty, his suggestions provided an opportunity for the STs to reconstruct the lessons using the students' voice/words. Also, Brad stated that STs would be able to "compare the two and consider ways in which they might have re-constructed the lesson based on disconnects between

the two perspectives." These suggestions were discussed during the I-LEAD PDs and were also applied by the MTFs. Brad also underlined the big idea of videotaping themselves, "[W]hy was it a critical incident for them and what did they learn from it? Then, they let a partner look at it and compare what they saw in it." This way of looking at the practices from others' lenses helped her (and all MTFs) build understanding of professional vision and identity. Thus, she became more aware of herself and her practices as seeing and defining from others' perspectives.

Ashley's issues with her ST stemmed from the fact that she was intentional about building relationships with her colleagues and her students. Her frustrations grew when she realized that her ST was damaging the relationships she thought was vital to successful teaching. In an interview from archival data in February 2013, Ashley was asked to elaborate on this issue with her ST. She stated,

> I'm very patient with my students and tell my students something fifteen times, and be like, 'Ah, they're just students that's what they do' but with adults 'Ah, you're an adult why do I have to tell you like fifteen times?' So that's the piece, the impatience, my personality is like a go-go-go, take on a lot of stuff, don't stick with any one thing for a long time, and his personality (her mentee) like this at all.

She further highlighted, "So, I think he knows them [instructional strategies], but knowing them and using them are two different things." Ashley also speculated that the STs' engineering background and his lack of pedagogy could have been the reasons why he struggled in building relationships with his students. She believed,

> He wants to do better as a teacher, and he thinks that, my perception is that he thinks that goes back to structuring his lessons plans and knowing the chemistry content, like he doesn't know how to go back and make that accessible to teenagers. I think he wants to, I

think he just doesn't know how to do that.

Ashley always asserted that she was good at building relationships with students, but she was not able to help him in dealing with both pedagogical and relational aspects of teaching: "I don't struggle with rapport and so it's hard for me to give him pointers and tips for how to build relationships." She also mentioned that the ST did not understand the importance of building relationship with the students. When Ashley was asked about the possible solution to overcome with this issue, she responded,

> Baby steps and to reiterate those over and over again, until those go smoothly in the classroom, so to not think that all of a sudden he has to be this fabulous teacher that I would want to take classes from but to realize that tiny bits of progress are still progress... what's going to work for him, how does he take those, internalize them and make them his own and come back with questions, trying to figure out that communication styling and timing piece.

Ashley's statement exhibited that she was aware of the fact that learning and progressing takes time for all learners. She also realized that the ST lacked motivation to build relationships with students and colleagues. When she reflected on her professional vision based on her ability to observe, notice, make sense of her mentoring practices, she also propounded her ability to deal with some problematic circumstances. She illustrated her ability to deal with problematic positions by the way she dealt with her ST's difficulty in learning pedagogy and communication. As Ashley continued her discussion, she spoke about the self-reflective approach to developing leadership skills and professional identity by helping novice teachers:

> I think that has been a big piece of me, developing who I am as an identity as a teacher leader, and then obviously just learning more content and just learning how to develop

> student teachers, we have three of them in our building right now. I've had to develop some of those leadership skills. And so just having that opportunity, it just forces upon you... So, just opportunities are there for me to develop more skills. I think help me become a better teacher leader.

Ashley was interviewed in February 2015. In the interview, she was asked about her mentoring practices and its influence on her teacher leadership. She surprisingly reflected on how her mentoring affected her professional identity:

> [T]he mentoring when I didn't feel like I was doing a good job impacted my professional identity negatively and it made me realize that different aspects of you as a person can come into play with different aspects of leadership and different aspects of your profession. So, I know there are people that think that I am NOT a great mentor and they have told me that they think that I am NOT a great mentor. So those conversations impact how you view yourself as part of your profession how you meant for people.

Ashley also explained the measures she took to overcome this negative impact. She first believed in her knowledge and practices. Second, she questioned herself about the areas of her weaknesses. She stated, "If I don't think I'm very good at it and it's being reinforced by this experience... maybe I'm not really good at it so it kind of makes you question the way that you do things." Although she thought that these struggles influenced her *professional identity*, she claimed, "[Y]ou can learn from that and become a better leader because of things that don't go well as much as you can from things that do go well."

Ashley believed that the primary exercise in teaching and coaching/mentoring was to link their (mentor leaders'-MTFs') own transition to teacher leadership, "[W]e take a lot of what we do when we are working with others as a terminal element - you were coaching - seeing one of

the elements." With these words, she illustrated mentoring as the crucial element of teacher leadership, as a particular experience, which could be achieved by training/advising novice teachers, that supports growing leadership skills, such as building interpersonal relationships. Ashley explained that this was the primary element of teacher leadership. This was observed to be a very important step to reach out and influence other teachers in developing both her own and their professional identity and professional vision. Working with others as exercising in teaching and mentoring enhanced her perspective in realizing her leadership capabilities (TL), her social skills to perform properly (PV), and her self-understanding of her roles, functions, and talents (PI). Relevant to this, she emphasized how mentoring extended her professional vision in an interview in February 2015:

> My professional vision has morphed into something where it's my job now to grow other people as teachers. It was to grow myself as a better teacher. So, through mentoring and through leadership positions that's what has changed my vision [her PV]. To lead other people, other adults, and figure out, how to work with them rather than just in my classroom and with that being my vision then mentoring comes into that so how do I help brand new teachers where teachers are teaching a new content area or teachers who are just struggling, how can I help those people by sharing my experiences. I have tried this and it went well, I would do something else and it wouldn't go well. And the same kind of thing with leadership—how would I put people in a position where they can be successful?

After all those challenging experiences she had with her ST, she later got a new mentee, a teaching fellow [TF]. It appeared that she applied some lessons she learned, such as motivating and giving smaller roles as baby steps to her new STs. Ashley described her new experience with

the new person in the email correspondences in 2013: “She was completely overwhelmed at first! She couldn't figure out how... But I told her it gets easier...” She was co-teaching with Ashley. She reflected on this by stating, “[it] has been great for me because I can use her to bounce ideas off of.” Most of the time Ashley’s mentee had been working with small groups of students and did not command a whole class. Later, her TF took over to teach a unit- Gas Laws, which Ashley believed was “a unit she could feel confident with.” It seemed that Ashley found a solution to engage STs with the students and their instructional activities. She further realized that she and her TF had different strengths. “[I] was trying to figure out how I can take my strengths and their strengths and, like, balance them out,” stated Ashley. Further, she explained the way she internalized this through her mentoring experience. In a February 2013 meeting, she suggested to another MTF in the group that while co-teaching, “Let go more when he [ST] is comfortable with it.”

The results from the reflection data (MTFs’ reflections to online discussion threads) indicated that the participants got great benefits through mentoring. The results also indicated the effectiveness of the Noyce program [I-LEAD] in enhancing the mentoring process. Ashley, for instance, stated,

> I think the Noyce program has done a couple of things. It’s definitely helped my confidence because I feel like we as a whole group, we get to talk about things that are working well, and it’s really judgment free. So people can provide feedback and but it’s all in a means of improving instruction or mentoring, or leadership skills.

Overview.

The discussions during the workshops and the project teams’ guidance helped the MTFs in enhancing their perspectives by being reflective on their mentoring practices. Although this

was a highly contentious topic, all MTFs demonstrated that they were progressing in the development of their mentoring capabilities. John was struggling with finding a right way to give feedback to his ST based on his expectations; then he realized his ST's strengths, ability, and capacity, and provided constructive feedback to his ST. His sense of mentoring, his leadership identity and vision changed dramatically and rapidly as he realized that the mentoring process was supposed to be mutually beneficial. Because Natalie was relatively new to mentoring, she focused on STs' strengths and gave tasks considering their capabilities earlier than the other MTFs. Additionally, she was new and thus was more open to getting feedback about her mentoring skills. Ashley's long time struggles with her mentee influenced her leadership identity, but she took lessons from the challenging experience. She began to use baby steps strategy to aid him as well as guide herself, and figured out how to put teachers in a position where they can contribute to the learning experiences of practicing teachers.

Thus, being reflective on all these experiences and sharing with others enhanced the participant's perceptions and practices in the creation of effective mentors. In addition, the MTFs were also able to improve their leadership skills in terms of creating positive relationships with mentees/colleagues, and effective teaching and learning activities. The data also illustrated that mentoring helped them with professional identity formation (realization of themselves—their backgrounds, talents, and experiences) and development of professional vision (productive ways of thinking and improving their practices—reconsideration of their activities and reconstruction of their action plans) that grew in the process of practicing.

Perceptions on Teacher Leadership.

Teacher leadership has been a foundational component of this research. The purpose of the I-LEAD leadership training project was to evolve teacher leaders' ability in translating

teacher leadership and to influence other teachers in developing effective instructional designs. For over three years in the I-LEAD project, the participants of the study, John, Ashley and Natalie [MTFs] demonstrated their perceptions on either/both formal or/and informal leadership roles and abilities. Their perceptions on the levels of awareness they had on the leadership roles they took were discussed during the professional development meetings, emails and interviews. The purpose of the study was to examine MTFs' perceptions of their leadership characteristics in a holistic way. Their perceptions of teacher leadership were presented here in the context of formal and informal leadership perspectives before and during the I-LEAD project. This provided an understanding of whether having a title/formal leadership role influenced their perceptions and leadership performances.

In the Context of Informal Leadership Position(s).

As evident from the section above, MTFs had defined leadership roles as department chairs, teacher leaders, and teacher mentors. Through this process, mentors reflected on their roles as formal teacher leaders. In the section below, I will discuss MTFs' leadership roles and perceptions they had prior to the workshops at Math and Science Partnership (MSP) program activities. This helped the researcher gain a comprehensive understanding of their leadership definitions. The research participants' leadership trajectories that revolved around their ideas on informal roles before and during the project were summarized around their insights.

John: "Setting the Paths and Helping People to Achieve their Goals".

John participated in the I-LEAD project as an experienced high school physics teacher with 11 years of experience in teaching. He was also a former department chair in his school. Additionally, he specialized in educational leadership in his master degree program. [Due to his previous experiences during his department chair position, his perceptions on his leadership roles

were examined separately in the context of informal and formal leadership]. Though his specialization guided him in his leadership skills, John stated that gaining, developing and internalizing leadership skills did not happen without practicing the knowledge: "So it was something that I was aware of the book definition of teacher leader, and being an educational leader but I don't think that I really embraced that role as a classroom teacher until doing I-LEAD." His initial teacher leadership definition was "maintaining the vision which is delegating, forming relationships, forming trust. And so, it's keeping your eye on the goal and then going about and finding ways to accomplish that."

After practicing his knowledge through the I-LEAD project, his view on teacher leaders' role and characteristics changed. On the other hand, it might be said that his internalization process reflected his perceptions, or vice versa. He detailed the reasons for that change that occurred after three years of experience in the project:

> Before then it was more of a formal thing for me. Since we have been doing I-LEAD I feel like it's been clearer to me about what a teacher leader should be, a true classroom teacher leader and a school teacher leader.

During the first year of the project meetings, John was sharing his perceptions self-assuredly. He- like Natalie- also claimed that the essential element of teacher leadership was *connective tissue*. He interpreted connective tissue as the connection between the ideas and concepts, and the rhythm of the class, and getting ideas out at times when students were ready to learn. He continued with the explanation of connective tissue in a leadership context and said,

> But also in a leadership sense, when ideas are ready for those teachers around you to hear them, and when is the next sort of segue into, *Okay, so you see that there's a problem here, maybe this will be a good idea for you to try*.

Initially, John felt that one of his primary focuses on teacher leadership was to be a teacher in the classroom first. In the summer meeting in 2012, it was stressed by the project leaders, "Teacher leaders' job is to influence the ones who are waiting for teacher leaders to bring enthusiasm and vision." Immediately, John responded, "That's an assessable goal for us because opposed to this—that's the same thing that we're trying to do in our classrooms." However, he did not see himself responsible out of classroom within his school; he stated, "The good news is that... you're not held accountable for your peers."

Regardless of John's views as building leadership in one's self first, he still sought informal ways to develop his leadership skill. He had been connecting with other superintendents, as some were his relatives. His concern was to know whether these connections influenced his interaction with his colleagues in the school. He wanted to know if he viewed school leadership in a different manner because he was around it in informal ways. He stated, "They [his peers] think that I somehow have some kind of foot in the door that allows me to do this [any role out of classroom]." However, he did not feel as if he had a "foot in the door" and felt that he wanted to explore leadership from different angles. He knew that leadership started with the teacher and their classroom first and then branched out to others. Moreover, he listed two reasons why he did not feel fully responsible for his peers in his initial years of being a leader: (a) He was much better at teaching than others so that he did not get the enthusiasm to perform better; and (b) Other teachers did not see his performance as better than theirs and hence they did not pay attention to him. He explained this reasoning:

> I teach physics, so I get all of the smart kids. And I don't have problems like they have, so they have to grade all their papers, and they can't let their kids grade their own quizzes, and they can't let this happen, and they can't not do lab reports. And so, I feel

like I might not be a great… I don't know, I don't feel like they buy into me. And so that's weird, because I didn't have that problem at South [his previous school].

John also tapped into other resources, such as building level administration to define leadership. In the June 2012 workshop, John touched on the principal's leadership roles. He claimed that his principal's position made their job easier to see and implement different teaching and learning activities. For John, teaching responsibilities were already loaded and complex. Thus, teachers could have more focus on their everyday classroom endeavors. He stated, "principals may have more of the 'bigger picture', which makes it easier for them to take leadership than for a teacher who is more focused on the day-to-day requirements of teaching."

Similarly, when he was asked about his interaction with his colleagues in an interview in January 2015, he advocated the same issue, which is focusing on classroom activities alone. According to John, this attitude of the teachers affected their interaction with each other. In addition to this, it was obviously seen in the following excerpt that he also underlined their workload even within the classrooms.

> It's strictly professional. Teaching high school is a weird job because you really don't see anyone except for maybe five percent of your day... most of your day is interacting with your students and it's not interacting with staff... everyone just kind of does their own thing, so I don't feel close to my colleagues I just feel like we're in a professional relationship.

A year later, in 2013, John became more eager to take more out of classroom roles. He stated, "I want to make myself uncomfortable to make myself do things; I am more of a consumer than a producer in the physics community." It appeared that he decided to leave his comfort-zone; that is his classroom. He expressed that attending the I-LEAD project, doing

science activities with his students at elementary school [where his sister is principal] once per semester, and reading additional sources enhanced his perspectives on efficient leadership characteristics.

At the third year, in 2014, his perception on teacher leadership roles and characteristics had transformed dramatically. In May 2014, when he was asked about his current leadership definition, it was observed that his teacher leadership definition was more comprehensive:

> When you are a leader in education it has 2 roles: You are trying to make those students better at critical thinking, at scientific thinking, at literacy. In terms of working with teachers you are trying to make them get better. You are sharing out ideas, you are sharing content knowledge, make them work more reflectively. Leadership is really just about setting on the path or helping people to achieve their goals and hopefully their goals are in line with the vision of the group... I'm not responsible for showing up; I'm not responsible for paying them. It's an interesting leadership role, because it is not like your typical leadership role.

Natalie: "The Path of Leadership is not linear".

Natalie participated in the I-LEAD project with hesitation. Since she was the youngest teacher in her science department, she was concerned about her age over participation in the I-LEAD project. When she attended the project, she had 5 years of teaching experience in a high school. During the first year of the project meetings, she frequently asserted, "I feel like they [other teachers] shouldn't have to listen to me, or like *I don't have to listen to you*, or *I don't have to do what you say."* As a young teacher without any title, it was a challenge for her to be a teacher leader. Thus, these limitations (being the youngest person without a title) appeared to prevent her from taking further steps to evolve her leadership skills. She expressed, "I don't want

to push too hard because then I don't want to be like, *I have the best way. You should do it my way.*" In March 2012 workshop, she clearly asserted, "I feel like my age kind of hurts me in this respect." Since Natalie was younger than most adults in her professional community, she expressed that a lot of people in her district, her county, or even within her school did not take her seriously as a leader. She also expressed a need in that aspect since this would have helped her to develop some abilities in handling the leadership responsibilities in an exemplary manner. She believed, "I need some skills. I need some approaches to how to be that person."

Before participating in the project, Natalie had taken some informal teacher leadership roles such as sharing new ideas with her colleagues, giving workshops, and being part of the hiring committee in her school. The information on her perception on other teachers' thoughts while giving workshops was found to be very important. She conducted a workshop for physical science teachers from other schools on physics and chemistry instructional practices. She stated, "They [other teachers at the workshop] thought I was super-smart because I worked with you [referring to Gary]. They were jealous because I knew how a candle worked, and how a flame." She believed that other teachers were aware of the fact that she knew well what she is doing for them. She stated, "But they are jealous..." [March workshop 2012]. When she was interviewed in June 2014, she also brought the same issue, which was her belief about others' thought about jealousy on her initiatives.

Natalie was eager to take more roles to provide some useful ideas to her colleagues. Though she had enough interest, it was noted that the school, especially her department chair did not support her. In October 2012 workshop, she further stated,

> I've been talking to her about doing some PASCO workshops… Because they [teachers at her school] don't use them may because they don't know how to use them. So, I talked

about, kind of doing a survey of who would be interested in coming to so this on one of our professional learning days. And, I'll take them through the lesson like the student, so that they can practice with it and get more familiar with it.

Her intention to share some useful ideas was obvious from the email exchanges she did on her faculty presentation (about flipped classroom model) with the I-LEAD project leader. Her enthusiasm to give workshops evidently showed that she worked to evolve her leadership skills. She firmly believed that being a worthy teacher leader is a process and it could be improved by practicing, sharing, and discussing teacher leadership skills in the project meetings, particularly. As she claimed, "[T]he process of being in this group, and the process of turning into a teacher leader, is not really a linear process."

At the beginning of the project, her attitude of listening less and acting more led her to face some challenges. This was reflected on some of her leadership characteristics that were derived from her personal attributes. In the same meeting, she elaborated this and evaluated herself and said, "I'm struggling about getting them [her colleagues] to work with me on stuff... maybe I take over conversations too much. So, I think that's what I've been trying to work on, is shutting up, and listening more."

In an interview from archival data in October 2013, Natalie was asked to share the views her colleagues' might have on her. She shared that her co-workers would see her as talkative and enthusiastic. She expressed, "I think that a lot of them would describe me as ambitious, blunt, outgoing, loud. I'm somebody who likes to share stuff with them and ask them questions." Based on her opinion, it was quite apparent that her excessive talking nature made her struggle when she attempted to bring people on the same page.

After one year of attending the I-LEAD meetings, in April 2013, Natalie seemed to extend her leadership identity and her leadership roles within her school. She started with working on personal relationships with her colleagues in her department, sharing activities that she had learned from the project meetings, and leading the group of teachers. She took more responsibilities by becoming part of the leadership team in her school. She stated, "Administration recognizes me as a leader. I've presented twice to my department and am still working on relationships. I do feel like I've made progress - working on the department. Some are coming around; I am trying."

Besides voluntarily taking active leadership roles in her school, her acceptance to the doctoral program had a positive impact on her public perception and her professional identity. As she asserted, "I think people see me as a leader." Even though she took more leadership and other related responsibilities, her beliefs about herself and on others' insights changed her approach.

After completing three years of participation in the I-LEAD project, in the third summer workshop series, it was observed that Natalie's leadership activities increased significantly and her perceptions on her leadership became more explicit. Her perceptions on teacher leadership definitions were distilled and pulled together from the different sessions of January and July workshops as follows:

> [A]t first, you have to first be able to see those connective tissues and functionality within your own classroom... then you start branching out within the school, and in the district, and in the community all at one time. I think that's just overwhelming – it's cognitive overload. Leadership is about forming those connections within the system... And, as a leader, you have to be able to gauge when somebody is receptive, and what

> you can do to try to draw them into the system. So, you need to do to try to help them feel connected... As the teacher-leader, you can't expect to keep doing the same things over and over again and achieve a different result. You have to try different things... You have to take risks; you have to be okay with failures, and not always feeling like you have the answers. That's essential to leadership.

Three significant ideas were found that were embedded in this passage, and those ideas echoed some of the essentials of leadership characteristics. The first one was connective tissues and collaboration; that is, making strong connections within the classroom and between other teachers and teacher leaders. According to her, branching within the school would start with working on those connections with collaborative colleagues and then with her department and school. The second one was the awareness of others' readiness to receive the new ideas and their capacity to take and appropriately carry out new roles. To accomplish this, the targeted teachers must primarily feel connected to the community. Thus, building positive rapport and communication networks became significant. The third one was risk-taking, which means that if teacher leaders never try anything new, they have not experienced failing; that meant no lessons could be learned to improve weak points/skills. Instead, they should have taken risks to try different ideas/ways to figure out the workability of the new system. These ways thus provided an opportunity to see the system differently than they had before. She expanded that *being transparent* must be central to practicing innovative ideas. She averred, "You have to just show people that you've taken a risk, and that you failed, so that they don't think, '*Oh, you're just this great person who never has any problems and everything's perfect in your world*.'" Lastly, Natalie also claimed that teacher leaders are those teachers who help develop other teachers or who help construct a better curriculum. Although she was the least experienced teacher, in terms

of years of teaching and mentoring, she was open to exploring all aspects of leadership – both defined and undefined leadership roles. She sought ways to become better at reaching her colleagues and was purposefully about the manner in which she developed as a leader.

Ashley: "People saw me as a teacher leader before I was a department chair".

Ashley participated in the I-LEAD project as an experienced high school chemistry teacher with 11 years of experience in teaching. She had a Bachelor of Science in Life Science Education. Also, she was pursuing her doctoral degree in Science Education. After attending the project, she also took a formal leadership position, which was the department chair role at her school; the I-LEAD project was found to be very influential on her by helping her to gain courage to apply and accept the position. As she expressed in an interview in February 2015, "There weren't really anything that was open that I decided not to take up, but I was also not really interested in taking positions even if they were going to be available to me." For this reason, in the following section, I will examine Ashley's perceptions on her leadership roles and characteristics mostly in the context of formal leadership.

Ashley shared some of her leadership roles that she undertook while acting as a teacher leader and before she began participating in the I-LEAD project. She had presented at the Georgia Science Teachers Association [GSTA] and National Science Teachers Association [NSTA] conferences a couple of times before participating in the I-LEAD project. She also stated that she was part of some professional communities at both state and national levels. In addition, she mentioned, "I did a little bit at the school serving on some committees on how to do remediation for students and things like that. But nothing that was like a formal position or title." She claimed that taking such active roles and those initiatives out of classroom "made people see

me as a teacher leader." Ashley further explained the reasons for taking responsibilities voluntarily:

> I'm a pretty vocal person, I express my opinion, but I'm also willing to get my hands dirty. So, I get in there and say something's not working, I try to volunteer my time and get in there and fix it. So I think doing that, about being vocal about what I think isn't working in department meetings even before I was department chair or in meetings with just chemistry teachers, one on one, but also getting in there and making change happen. I think that's what helped people see me as a teacher leader before I was a department chair.

Informally, Ashley was willing to serve in leadership positions without titles because she was vocal and felt that she could aid in finding solutions. Although limited in time, due to her quick progression as a department chair, her beliefs about being an active teacher leader existed outside of having a title. In the following section, I will discuss Ashley's and John's perceptions of leadership in the context of formal leadership positions.

In the Context of Formal Leadership Position(s).

John, as a former science department chair, and Ashley, as a current science department chair, at their respective schools shared their perceptions and experiences on their formal leadership roles. Although they had common perceptions at some points (i.e., that is easier to say things and direct others when one has an official leadership title), their insights were diverse over the professional development meetings and the interviews. In this section, their views on their formal roles were discussed without comparison to their own merits. The differences that predominantly proceeded from their personal and professional identities and professional visions and experiences with different people in different communities as well as some other influential

factors are discussed.

John: "Having a positive influence on their teaching practices".

Nine years ago, John held a department chair position at his previous school. During that period, he was in his fifth year of teaching. This position was offered to him and he accepted it without hesitation. However, "[I]t was really scary though and it wasn't something I think I was ready for even though I really enjoyed the road there. I think that I learned a lot at this actual teacher leaders position," he said in the January 2015 interview.

He continued with some noticeable advantages of having a title in terms of performing and communicating better with others' while sharing ideas and teaching applications. He claimed that the department chair position gave him a different platform to try to get other teachers to buy into his ideology. However, when he did not have a formal leadership position/title, he believed that his colleagues thought, "You're the same position as me. Why are you sharing this with me? Do you feel like I'm a bad teacher?" He argued,

> Where as when you are a department chair it's a little bit easier to say, *Hey look why don't we try this as a department*. And, it was automatically accepted because of your position... without stepping on toes or without making people feel insecure or resentful towards you when you make suggestions: *Hey let's try this out*. *Hey this is what we're doing, so let's do it*. It was a little bit easier from that role then it is from just a regular teacher role. It's a lot more accepted.

In the October 2012 workshop, Natalie, who taught at the same school when John was a department chair, noted how he took the title's benefit and acted as a teacher leader in an effective way: "What I see is that I think you had a lot better buy-in at Mainland High School [John's previous and Natalie's current school]... we were like, *John, the god*. *Oh, lead us John*."

Then, John responded by comparing himself and others in his previous and current school. He said, “That’s the impression I gave because I came in [to his new school] sitting on a throne and stuff – and not that many people were carrying me.” Although he complained about not being heard by his colleagues without holding a formal position, he asserted that he would not like to have a formal title again. Since he surprisingly stated,

> You really don’t interact with kids as much as you used to, and that doesn’t seem interesting to me. In much of the same way, part of what makes it fun to do is working with those teachers, building that community, and feeling like you are having a positive influence on their teaching practices, so I wouldn’t like it.

When Gary [a project leader] asked him whether he wanted to have the role of principal so that he would be able to change culture, he began his responded that he wanted a position without the title. Here, it is important to highlight two critical points: (a) John preferred to take teaching role to students and other teachers, but specifically students, and (b) life with a formal title was ruled with commanding that people to do better jobs, but people most likely avoided advice because of the position. His other reason was that he gave priority to balancing his job and his family life. Additionally, in an interview from archival data in 2014, he was asked about the reason why he changed his school and why he was reluctant to hold a department chair position again. He additionally asserted, “I still regret having to give up the leadership role, but the pull of family what's more important.”

As covered in the previous section (under the informal roles) and here, John likes teaching and interacting with students more than the formal processes of being a teacher leader. Additionally, he preferred to take some other roles that would influence others’ teaching and learning practices without a title of formal leadership position.

Ashley: "Becoming Department Chair Formalizes the Process".

In Ashley's case, she had been serving as a science department chair at her school for two years. Often, she also shared in administrative duties. Ashley's role as a department chair included "doing more of the paper work and administrative stuff, trying to deal with schedules, making sure that the class sizes are right, having enough people, assisting teacher evaluations, supervising and facilitating the other teachers, and providing supports." In an interview from archival data in February 2013, she touched on some other roles in STEM related initiatives that she was involved as a teacher leader at her school: "[W]e have gotten an innovation grant to train math and science teachers in problem based learning; and we're going to get some additional equipment and have some STEM courses." With all her experiences as a department chair, she claimed, "[B]ecoming department chair was kind of formalizing that process through assigned roles." She further explained the other advantages of having a title that influenced her confidence and interactions with others:

> [J]ust the title, gives me a little bit more leeway to go into people's classrooms and say, *Oh I saw this really cool idea when I was at my meeting on Saturday and I think you would really benefit from it*. So, I feel that people maybe respect my ideas more now... it's given me a little bit of a forum to how to facilitate the conversations that I think we should be having in our science department and given me some confidence... I can run the agenda, and ask people to present what they're doing in their classes... I have more control over as the department chair.

Although there were some benefits, Ashley realized that there were challenges that came with having a defined leadership title. Ashley specifically shared three challenging areas that she had to work through over the time. The first one was about changing other teachers' perceptions

of what she could control. She stated, “There are a lot of things that are out of my control that people think are in my control. So, I have to deal with people being upset about things that I don’t have any power over” [Interview from archival data, February 2013]. The second challenge that she faced was in giving feedback to other teachers on their classes, which is a part of classroom observations. When Ashley conducted classroom observations for other teachers, she struggled to provide verbal feedback appropriately. The following excerpt from June 2014 interview from archival data showed her struggle on that:

> But I haven’t found a way to find the time to say “Oh, you’re doing this, that’s really cool, have you thought about doing this?” And add on to what they’re doing, but that’s what we should be doing as department chairs and what other people are doing to help and give them ideas about what they could be doing in their classrooms.

The third challenge was to make connections on teaching practices between her department and other departments. She asserted that in a very large school like hers, teachers tend to be isolated. She also stated that it was a part of her duty as the department chair to create connections between departments. She had been working on the measures that could be taken to share the ideas and resources between departments so that it could be applied to their respective departments. As she stated, “trying to figure out all of that has been my latest undertaking as far as leadership skills.”

Communication skills played a significant role in being a successful teacher leader in all study participants’ cases. It was Ashely’s communication skills that helped her to accomplish her roles and deal with her struggles. Although she began building relationships before taking on formal leadership positions, she mainly developed relationships “through being a department chair” as she said. But, as she expressed, “the building relationships piece sometimes takes a

while." She further stated, "Once I build those relationships, it opens up the communication a little bit more. So, being like, *How can we move things around? How strict are you going to be about stuff?*"

After participating in the I-LEAD project for three years, she shared the lessons she learned and expressed that she understood what needed to be given priority in a leadership journey. Besides these, in the January 2014 workshop, she also noted the influence of the I-LEAD project through their discussions on their experiences:

> [H]earing people talk about having trouble... So just seeing the way that people's personalities impact the way that they work with others and seeing that it's never totally smooth sailing no matter what you do that you're going to hit bumps and that's okay you can learn from those and move on. I think that has been the most impactful thing. To me that it makes it okay to make mistakes as long as you are trying to do what is best, and I think sometimes as adults that is hard for us is to understand that we can make mistakes and still learn from them.

Ashley believed that another advantage to developing leadership skills was the support she gained at her school (e.g., Principal and administrators). In the February 2015 interview, she reflected on the type of support and opportunities that had been provided to improve her skills in leadership:

> I think that is something that is unique to our school where people go through that program and potentially might become a department chair if that spot opens up or you might do some instructional coaching with other departments. So, there are a lot of opportunities for teachers to be involved in a leadership aspect of the school. I have started doing some of the course leads when it first started 7 or 8 years ago. I have service

on some of the committees. People do a really good job of looking at where your strengths are and trying to figure out how you fit into the big picture. They look at people who have an innate ability in one area and they try to develop that interest in one area and develop that.

Ashley became more aware of the methods that she could use to help teachers become successful in their roles. She often realized that larger groups worked less efficiently than smaller groups. Therefore, she decided to build teams based on their interests "like Brad and Gary have done for us some in the I-LEAD." She got inspired by the I-LEAD project leaders' roles and implementations. She stated, "It's a really effective way for them to deliver professional development instead of as a whole group. So, that is something that I want to implement more in my department." The following excerpt illustrated how she implemented the idea of dividing people into work groups:

> I feel like it's divided into two groups, people who I really work and communicate well with. We can have honest conversations about something works and something doesn't work... The second group is more experienced teachers they have all been teaching much longer than I have. So that may be part of it, that they've been teaching the same way for a very long time, and I'm coming in and trying to change things. Because I think that it is better for our students.

Moreover, she also identified the areas of work that she improved over the last two years, such as being patient about others' progress and accepting their shortcomings. She stated:

> It's been very interesting I would say the past year or two I feel like I've grown a lot professionally and how I teach. And how I interact with adults (teachers) and I feel like there are people that have not made progress things that I would have considered to be

more normal. People are not as professional as I would like them to be. Because they're doing things that I don't think it is appropriate in their role, but it's not in my role to tell them not to do that.

Ashley was confident that successful leadership depended on meeting teachers where they were and helping them get to where they wanted to be. In addition to splitting her colleagues into manageable working groups, she also pushed them to explore more leadership opportunities. She stated, "I have all of these opportunities, how do I not give other people opportunities also?" Ashley also worked on being an influential person in others' instructional and leadership practices. Meanwhile, she also improved her leadership skills. She stated that she worked on implementing certain measures that could place people into positions where they can be successful. She also worked on organizing her department in a way that would allow people "to take on leadership roles and to feel confident in their abilities." She continued to implement leadership activities that she used to do in the school, "I know for me what is important is growing people as teacher leaders, and as better teachers in the classroom. Then, I can think about baby steps that it takes to get there." Additionally, she highlighted, "I think I have a lot of influence as a liaison between teachers and leaders; they take what I say into consideration."

In brief, the fact that she reached out above and beyond her initial insights ("I don't feel comfortable enough with it right now to answer their [co-workers] question...so, experience is needed.") illustrated her evolution in the journey to leadership. Ashley's explanations of her leadership roles and characteristics over three years of participating in the I-LEAD project illustrated that her leadership abilities were nurtured and matured over time by the experiences she gained both from her school and from the I-LEAD project.

Overview.

Natalie began her leadership journey as young teacher without a formal leadership position/title. However, her progress was not linear as she claimed. Her leadership development process illustrated her evolving leadership performance, professional vision and identity through her volunteer, out-of-classroom activities in being influential on others. The data illustrated that Natalie acquired some effective leadership characteristics, including being a risk taker, reflective practitioner, and an eagerness to contribute despite some discouraging factors from her school. She has been working on leading teaching and learning practices by embracing new methods. John as former teacher leader was developed in several aspects of teacher leadership. Like Natalie, he emphasized an important element, which is *connective tissue* between ideas, roles, classrooms and administrative tasks. He volunteered to help other teachers, but without a formal leadership position/title. His only need was seeing value in his job performance. For him, a title was not necessary to help other teachers. Since he liked being flexible in applying innovative ideas and approaching with his own way of doing/leading. Otherwise, he was assertive in terms of taking on additional and influential roles. Over three years that he participated in I-LEAD, he extended his theoretical and practical view on teacher leaders' roles and characteristics (communicating better with others as sharing ideas), professional vision (noticing the importance of influencing others' teaching and learning practices without having a formal leadership position) and identity (realization his priorities—e.g., interaction more with students and family). Ashley's capacity and commitment to contribute to teacher leadership beyond her classroom existed before participating in I-LEAD program. Having a formal title, she established practices (such as small working groups) that helped others' progress within her department. In addition, Ashley's broader view of leadership, her school's supportive structure, and her supportive

personal/professional talents helped her to reach her full potential as a teacher leader.

Impacts of I-LEAD.

The influence of the I-LEAD project on potential teacher leaders, MTFs, was illustrated using the data presented in this section. The impact of the set of professional development activities and goals (created by the project developers and MTFs) that were carried out by I-LEAD was significant. As primary and secondary roles of the project, the formation and reconstruction of the MTFs' professional vision and identity as well as their leadership performance as evolving teacher leaders were discussed. To comprehensively understand the influence of the project activities' on the MTFs' easily observable (i.e., leadership roles, skills, etc.) and nearly observable (i.e., professional vision and identity) leadership trajectory, the results were presented as follows: First, overview of the I-LEAD professional development activities, and second the participants' insights obtained from various data sources were discussed. Participants' insights on group goals and video discussions were identified and discussed in this section.

Supporting Potential Teacher Leaders: Overview of I-LEAD Professional Developments in Evolving Teacher Leaders.

The I-LEAD project supports the MTFs in a progression towards teacher leadership, primarily through in-service professional development activities. The project developers (Brad, Gary, and other team members), while designing the professional development (PD) experiences, considered: (a) improving the content and pedagogical content knowledge (PCK) of the MTFs, (b) creating a professional learning community with a central focus on developing the professional vision (and professional identity afterward) of its participants, and (c) creating influential, exemplary and mentors and teacher leaders. In each PD, decisions about what was

appropriate to deliver were informed by both educational theories and the practical experiences of the project developers as former K-12 teachers in diverse and challenging science classrooms.

The MTFs from cohort 1 made a five-year commitment to participate in intensive, sustained professional development. This included a one-week workshop each of the five summers of their participation, four to six daylong workshops during the academic year (held on Fridays and Saturdays), and attendance at professional conferences. Their activities to support the MTFs' growth towards becoming teacher leaders are briefly explained in this section to explain: (a) the MTFs' leadership trajectory; and (b) changes in their leadership identities, visions and roles through their participation in an I-LEAD professional development leadership program. It is important to note that the activities were derived from the project's proposed goals and plans and included here after cross checking with numerous sources (i.e., archival data, annual reports and field notes) to assure what were carried out from the proposed plans. Table 4 summarizes the roles of the MTFs and the activities developed and utilized by the project team members to support their development towards teacher leadership.

Table 4

Summary of MTF Activities

Year-Role of MTF (TL Trajectory)	**Activities to Support MTF Leadership Development**		
	Phase #1	Phase #2	Phase #3
Year 1: Developing Classroom Leadership & mentoring	PD/Coursework to develop pedagogical content knowledge	PD/Coursework to develop mentoring skills	Participation as MAT (pre-service) teacher mentors
Year 2: TF Induction Mentoring	PD/Coursework to enhance Professional Vision (Classroom Interactions)	Participation as Noyce TF PD co-presenters with KSU/GT/RESA faculty	Participation as Noyce TF induction mentors
Year 3: Emerging Local Leader	PD/Coursework to enhance Professional	Seeking leadership opportunities at local and/or state levels	Participation as Noyce TF, Scholar, or

	Vision (Video and discourse analysis)		MAT (pre-service) mentors
Year 4: Emerging State/Regional Leader **Year 5**: Emerging State/Regional Leader	PD/Coursework to develop leadership skills (e.g., Action Research, grant writing, publishing journal articles)	Seeking leadership opportunities at state, regional and/or national levels (e.g., committees, task forces, governing boards)	Participation as regional/national mentor (e.g., national lab day, AP consultant, listserv moderator)

Year 1 of the MTFs participation began with a one-week workshop in which the project developers collaborated with the Metropolitan Regional Education Service Agency (MRESA) to facilitate completion of the Teacher Support Specialist (TSS) endorsement. A key outcome of this professional learning opportunity was to help the MTFs see the classroom differently so that they can provide more meaningful and reform-oriented feedback to the TFs when they serve as mentors the following spring (end of Year 1 for TFs). The remaining time in this workshop was devoted to the conducting video analysis of discipline-specific (chemistry and physics) teaching episodes. The MTFs identified effective elements of instruction and created analytical notes. Individual analysis continued with analyzing sample lessons presented during workshops and conducting classroom observations. To further practice their developing mentoring skills, each MTF was paired with a pre-service TF during the TFs' field-based practicum (approximately 500 hours) in the spring (Year 1) term. Project developers served as facilitators and mediators as the practicum instructors and provided additional PD and support to both mentor (MTF) and mentee (TF) during site-based visits to the school several times during the semester. A reflective journal for each participant (MTF, TF, and faculty) documented the challenges and growth experienced, and was discussed with the larger Noyce community during the yearly academic meetings.

In the summer of Year 2, there was a one-week workshop with continued focus on the growth of the MTFs professional vision. During the workshop, participants engaged in a paired

analysis of a lesson taught by the TF at the end of the spring clinical experience. A second emphasis of the workshop was continued pedagogical content knowledge (PCK) development as the I-LEAD project faculty conducted discipline-specific activity sessions designed in a manner consistent with our previous PD work in which the MTFs engaged in the activities that allowed them to experience the program as their students would. This dual emphasis on professional vision and PCK development, which were explicitly stated to the MTFs, was intended to support the MTFs' emerging image of themselves as capable reflective practitioners.

Communication between the MTFs and TFs was facilitated by electronic media sources (i.e., wiki spaces, discussion boards). The MTFs were asked to observe the TFs once each semester as part of their induction support efforts; the TFs and MTFs separately analyzed the lesson. The MTFs were engaged in their own professional growth as they begin to pursue additional endorsements, which were offered in conjunction with the Metro RESA such as Gifted Education and Georgia Master Teacher. Alternatively, the MTFs were encouraged to take graduate courses such as Classroom Interactions, a science-specific graduate course designed to help teachers look more closely at dynamics encountered during classroom instruction. Finally, the MTFs participated in the ongoing academic year Friday workshops, which were held twice each semester and had a similar structure to those offered in Year 1.

In Year 3, the MTFs were encouraged to take on a local leadership role that highlighted certain aspects of their professional vision developed during the first two years of the program. They achieved their goal by participating in one or more opportunities. For instance, the MTFs were encouraged to (a) conduct sessions in the third week-long summer workshop designed to support the content and pedagogical growth of the TFs in the program; and (b) present at meetings of local chemistry and physics teacher alliances (i.e., AAPT, PTRA). The MTFs were

supported financially and academically to attend state, regional, and national conferences by co-presenting with an I-LEAD team member or on their own. Additionally, the MTFs were encouraged to continue their professional development trajectories such as to the attainment of endorsements, certifications (e.g., Advanced Placement) and the pursuit of graduate courses related to their discipline. One endorsement option (Master Teacher), for example, was designed to insure that the MTFs had sufficient training as identified by potential teacher leaders.

Within the first three years of participating in the program, the evolution in the MTFs professional vision allowed them to move from peripheral participants to central participants in local communities of practice in science education arena. This transition supported their growth and confidence to function as local leaders. The focus of the last two years (Years 4 and 5) were to encourage the MTFs' involvement in larger communities of practice, their continued growth into teacher as scholars, and becoming 'teachers as learning partners.' There were two primary vehicles for attaining these milestones: taking on leadership roles at state and national conferences and increased attention to educational research. With respect to these, the MTFs were supported in sharing aspects of the evolution of their professional vision through conference presentations and the sole or co-authorship of practitioner-based manuscripts and articles. During these last two years, KSU faculty visited the MTFs twice a semester to support their efforts in these areas.

By engaging in an array of leadership activities over the course of the project's timeline (within the first three years), it was anticipated that the MTFs evolve the level of professional vision (professional identity and leadership attributes) by the project leaders. Thus, to understand whether and how engaging with the PD activities affect the MTFs' views on their leadership roles and characteristics, professional vision, and professional identity, their perceptions on

possible impressions through the I-LEAD process, are discussed in the following section.

Impacts of I-LEAD on Professional Vision and Identity and Leadership Characteristics: An Imperative Outcome- Evolution in Progress.

The I-LEAD project team ensured that the project's objectives prepared the MTFs to become agents of change. The project team insisted on this particular goal because they were aware of the fact that each potential teacher leader was a master teacher who came to the profession with various professional visions and identities and also with different capacities. An improvement in these attributes began with seeing and thinking differently before acting differently. With respect to this, Gary (a project leader) explained that the professional development activities were intended to help the MTFs to see their critical roles and responsibilities as teacher leaders. Also, he reflected on the way in which this process should be and the project developers' challenges in creating teacher leaders: "We are learning together. I think it is really hard for us sometimes... but I am sharing what I have to bring in the conversation." [October workshop 2012]

Brad (another project developer) further emphasized the role of critical thinking in improving the MTFs' professional vision. After the MTFs created goals, under the project developers' guidance, Brad underlined the ultimate purpose about the goals: "[H]ow we organize ourselves to accomplish some of these?" The reasons to focus on personal and group goals were to reveal, understand, and improve the MTFs' developmental level of their leadership abilities, professional vision, and identity through their self-reflective and self-regulative process. Based on the participant's interests, capabilities, and available resources, the MTFs reorganized their goals by creating sub-categories that focused on one or two goals. Brad further emphasized that their target was to focus on one or few of the defined goals by each MTFs so that they could be

more productive and stressed less.

During workshops in 2012, project developers (a) encouraged the first MTF cohort to focus on creating and clarifying group goals that needed to be accomplished by the end of the project, and (b) revisited and revised the goals to be accomplished both in the near and distant future. For instance, the first set of goals the first cohort of MTFs developed for the I-LEAD project in October 2012 were about deepening their own content and pedagogical knowledge, developing a framework for engaging in a mentoring/induction program, organizing outreach activities for K-12 teachers, becoming change agents in department/school/county/state, and developing data analysis methods to capture the impact and effectiveness on teaching. The MTFs' discussion regarding the goals was very insightful. Their discussion was underpinned by literature that indicated teachers' (especially K-8) need for strong pedagogical (content) knowledge and effective instructional strategies for K-12 science teachers through functional professional development activities to improve science teaching. On that day Brad explicitly stated, "[O]ne of the goals that we have for you – is to have you develop a professional vision through this program."

After revising the goals, the MTFs' particular focuses became clear during the following workshop discussions in 2012. In the October 2012 workshop, Natalie suggested creating teachable moments for more powerful instruction, including changing direction when necessary. Ashley described a goal related to analyzing classroom practices, which would support her and her colleagues in obtaining a sophisticated professional vision. Ashley argued for the importance of being reflective about and critical on the effectiveness of the instructional strategies they were using. She stated, "So, looking at certain groups of students, certain lessons, and trying to figure out, *Is that really the best way to do things?*" She also offered a qualitative analysis to determine

whether the initiative they used was working. John underlined that his overall goal was to become a *change agent*: "[R]elate to group goals is, just getting a bigger and bigger picture of being a change agent." In June 2013, the spectrum of their goals extended and also embraced other details such as (a) understanding scientific details [Ashley], (b) defining students' prior knowledge [Natalie], and (c) unearthing and helping correction of students' misconceptions [John].

In 2014, when the MTFs were asked about their plans in terms of reconstructing their professional identity and leadership skills, their approaches were noted. John wanted to do some collaborative work with other physics major MTFs (from second cohort). He also wanted to create some dynamic lesson plans that could be shared at national conferences. Ashley wanted to finish her dissertation and "translate like doing things like working with troubled students, working with adults who are struggling, helping with redeveloping the curriculum for the county." In addition to that, as asserted in the previous section, she also wanted to create an interdisciplinary approach by connecting the departments at her school so that the resources, good teaching practices, and lessons learned could be shared among the teachers. Natalie's next plans included publishing scholarly work that would contribute to the field. She also expressed her desire to be a strong leader, like Brad and Gary (project leaders). Natalie claimed that she planned to develop the skills that could be used by others for their instructional and leadership development. To be able to reach that goal, "I really have to keep doing what I am doing and learning more, reading more, reflecting more," said Natalie. She also elaborated on the reasons that made her want to take the project leaders as role models:

> Just continuing to stay engaged with Brad and Gary and within the research is how I see being able to continue the process of keep refining what I see. One day when I'm all

> grown up I'm going to be the next Brad and Gary, I want to develop more Me's. I want to take teachers that have more teacher development potential and be able to take them trough the journey that I am going through into teacher leadership.

During an interview from archival data in February 2013, Ashley also expressed the same sentiment and explained this as the most significant effect that the I-LEAD program had on her. The program helped her in her professional development, such as structuring department meetings. It appeared that Ashley, like Natalie, also thought of Brad and Gary (project developers) as role models. She learned about organizational skills from the way Brad and Gary organized the professional development sessions for I-LEAD. She observed their position, roles, and practices and incorporated those that could be used in her leadership practices as a department chair. She stated,

> [T]he biggest thing that the Noyce [I-LEAD] has done, it's provided a script for me to use when I design the department meetings and really put a focus on what good science teaching looks like and pulling that in for everyone to see... I became a Noyce scholar, so sometimes it'd be like I was disseminating information, so like, "Here's when you'll need to know about scheduling, here's when your grades have to be in, here's the meetings for this week" and now it's more about like finding ways where we can learn from each other as teachers.

During the same interview [February 2013], Ashley also explained other significant influential factors of the I-LEAD program. According to her, the I-LEAD program helped her to become more skillful in teaching science content, more knowledgeable in regard to using pedagogy to teach science, more effective in building positive relationships with others, and also more open to learning different leadership styles. Consequently, the program increased her

confidence in teaching. To explore the longevity of the program's influences, an interview was conducted two years later in February 2015. Ashley was asked again about the type of contribution to her leadership knowledge and the skills she had noticed as a result of her participation in I-LEAD. She readily responded in detail. She explained the ways the program enhanced her recognition of teacher leadership:

> Part of what influences the changes, again when I go back to what I've learned in I-LEAD, I have just become a lot more comfortable with the content and different pedagogical approaches and so in some ways it makes me a better candidate for teacher leader because I have a more than a bag of tricks when things are working this way then you can try this so I have become a resource person can you use these different ideas in your classroom.
>
> AND
>
> The biggest thing that I learned during I-LEAD that helped me, is just how to communicate with different people... through I-LEAD we are with people from very different schools, and hearing how things work at other schools gave me a better understanding of the broad view of science education going on in all of these different classrooms... I think I've been able to expand that to science teachers. It has made me be able to discuss on true content I am doing a better job of teaching in depth chemistry content... It's just me more comfortable as a leader in general how to present my ideas to people so they hear them they understand them. Hopefully they agree with them in figuring out where my contribution is the most important, the local school level, the county, or the state level.

Ashley was noticeably aware of the professional enhancements that she received by her

participation in the I-LEAD program. Her leadership practices and her professional vision were significantly modified. There was evidence of an increased ability to create a positive rapport with her colleagues to share innovative science teaching approaches at a broad level. Participating in the I-LEAD program not only extended her professional knowledge (content and pedagogical content), but also her views and actions in regard to sharing with those in her leadership pathway. Thus, the study found that her self-efficacy, confidence, and beliefs in her leadership capabilities were amplified by the I-LEAD program. She confidently began to see herself as an accessible role model for her discipline. She said, "[W]e can model for teachers."

Many of changes that Ashley made were detailed in an email correspondence with Brad, one of the I-LEAD project leader. Based on that correspondence, it seems as if her professional vision was further developed through the deliberate action on her part. She purposefully worked to apply the strategies suggested by Brad, e.g., writing reflections on their pedagogical practices from both the teacher's and students' perspectives, helped her in enhancing her teaching skills, similar to Natalie. Ashley's practice of having teachers videotape themselves and reflect on the lesson alone and with others illustrated her intention to help others to strengthen their ability to teach content. Another advantage of being a part of professional learning community (I-LEAD) was the encouragement that she received. The suggestions that were given by the project leaders helped the participants to enhance their teaching practices. To substantiate this, as an example, one of Brad's motivational responses is provided below to demonstrate the impact of sharing ideas and having people consult with the project leaders. Brad wrote to Ashley with a reference to her action plan on a summer working group with other teachers:

> It is great to hear that you are rethinking things. I know when we had the one Noyce session, you felt pretty constrained by G's (her school county) curriculum, so it is a

positive to hear that you are thinking about working within / around it to change things. I would be glad to give you my whole intro chemistry curriculum.

I-LEAD project activities such as video discussions also had an impact on MTFs' PV and PI development. To support the MTFs in further envisioning the fundamental ideas that were introduced in the March workshop in 2012, the MTFs were given the assignment of videotaping one or two lessons that represented their teaching methodologies. More importantly, they were encouraged to present a critical incident to discuss deeply with the group (other MTFs and project leaders). During this discussion, the participants questioned each other to push thinking and consequently to suggest better implementations. The heart of their discussions was to identify the problem(s), understand the causes (cause analysis), and to find the best ways to solve the problematic areas, and to improve other areas if necessary. To take full advantage of these discussion opportunities, the learning environment maintained a positive atmosphere so that the participants were comfortable sharing their ideas. Thus, it was very important to note that the discussions took place in an nurturing community-focused environment. All MTFs explained their own activities/experiences comfortably and respectfully. This was observed to be one of the key components of professional learning and growing communities. To illustrate those critical components, the following set of excerpts, as evidence, were chosen from a workshop-video discussion held in December 2012. This discussion was critical to Ashley as she had been challenged with mentoring experiences that obviously affected her professional identity. Ashley showed a critical incident - a dialog between her and her mentee, identified the problem, shared possible causes of the problem, and her additional effort to resolve the problem, and asked for other's suggestions:

When I give feedback, a lot of times, what I hear are excuses for why things didn't go

well... I don't know how to get rid of those excuses because they feel like a barrier to getting better... I don't know what strategies to give him [her mentee] to bond him with the kids... I don't know how to help him find his identity... I would love suggestions on how to overcome that.

Others in the group shared their thoughts and suggestions with her. Although this section took more than an hour of dialogue, the following excerpts show the diverse perspectives and suggestions that were shared with Ashley:

[Brad's suggestion] So, why not show him…here's what I would do in this situation. I would videotape when you are teaching the lesson and he is teaching the lesson to see from the students' perspective. Look at these two video clips and what do you see happening with the students?

[Gary's suggestion] So then, consider maybe a root cause analysis. We both agree or not on this. Why? And back up through what the root causes are. Discard that extraneous minutia; you're going to get to the bottom probably of you…the kids do not relate to you. They don't think you care. Okay? So here's the problem, here's the cause. What do we do?

[Natalie's suggestion] When we do stuff similar to that, I share out too so that they get to know about me. Do you know what I'm saying? Like does he have a dog or kids or anything he can talk about?

[John's suggestion] Would there be, like, some kind of lab that you could let him do that the kids would really get into, like with blowing something up or doing something where it's just really cool that they would be hooked by at least, well, that was really cool. And then, uh, give him some sort of platform to help them understand what's going on without him being the expert on it.

Ashley, as an evolving teacher leader, wanted to be influential to others' by not only helping them to gain the necessary pedagogical skill set, but also by improving their professional identity and vision. When Ashley struggled to do so, the suggestions and critical (and constructive) feedback given by other MTFs and project leaders helped her to see the issue from multiple perspectives. Ashley applied the suggestions that worked for others (i.e., doing lab activities and real life connections with kids and touching students' personal life, values and beliefs) to her own situation over time. She also had the support from the group. As she spoke about the challenges that affected her professional identity and vision, she also claimed, "[T]hose conversations impact how you view yourself as part of your profession and what you meant for people." [February 2015 interview]

Another type of video discussion focused on the ideas embedded in the videos, including TED talks, YouTube videos, and other educational videos derived from particular websites. These videos were shown either by the project leaders or by the MTFs to initiate discussions. The intention behind these video discussions was to emphasize those ideas in the MTFs teaching, mentoring and leadership practices. Brad, for example, showed the 'Gorilla' video that was about *selective attention*, to discuss the significance of seeing bigger picture as opposed to focusing on one or two things then related it to the notion of professional vision. Another video that influenced the MTFs' insights were the interviews with Robert De Niro and Jerry Seinfeld, two famous and successful comedians. The MTFs' shared insights on the main ideas of these videos; their inferences were discussed in a different section [relationship between professional vision, identity and leadership characteristics were deliberated]. The important element under study was the effect of intentional and planned professional activities on evolving teacher leaders. Different examples of videos helped the MTFs realize the various approaches that exist and modeled how

to make use of those methods or how to create their own professional approaches. These real life connections helped the MTFs gain a broader view of their practices. The people (project team, other MTFs and colleagues at their schools) and the videos were found to be influential on the MTFs' productive thinking processes. Focusing on the videos and the discussions around them helped the MTFs gain different ways of understanding their PV and PI construction. This process improved the participants' practice (PV) and self-understanding (PI) and also created/improved leadership performance. The goal of the video discussions during the workshops to were to assist the MTFs in (a) identifying desirable changes in their own practice by characterizing its current form and (b) reconstructing their views and abilities with necessary changes through looking differently.

Related the video discussions, Natalie and John gave presentations on their videotaped lessons in April 2012 workshop. During their presentations, their comments on their own lessons and each other's lessons exhibited the way they saw each other's practices and made sense of their own professional practices. For instance, Natalie spent her time over winter break thinking of "how I could change some stuff". She chose the topic of atomic structure and isotopes for presentation since she claimed, "they're very elusive to students". She was confident on her content knowledge, but she wanted to focus on facilitating small-group discussions with a hands-on activity related to the topic. She realized, "they [her students] were questioning one another... I noticed that some of my kids were way more prepared to do discovery than others." She, however, was not sure if she was on the right track and wanted the group to help her reflect upon it. After a set of conversations around this issue, she realized another effective component of teaching pedagogy: differentiation. "I should probably incorporate some more scaffolding maybe, or maybe some more differentiation between my groups... Maybe I should have tried to do some

mixed grouping." During her presentation, she had an opportunity to give some background information about the activity. She explained her rationale behind the approach and looked to get feedback from other MTFs and project staff, and question her practices. Such discussions made her revise her perspectives and pedagogical strategies. She asserted in the same meeting that the revised approach on her pedagogy produced better learning than in previous years.

As they commented to each other's applications, they were expected to be reflective on their own practices. For instance, Natalie made a comment on John's lesson episode and continued with critically reflecting on her own experiences. "I like that you showed us that from a different perspective because none of us were looking at it through that view." John responded, "I went ahead and made it critical of myself." During their discussions about some other critical components of effective teaching, their interactions explicitly helped them to share their thoughts and experiences without any hesitation.

At another angle, John advocated some other significantly effective factors of the I-LEAD program during his interview in January 2015. When John was questioned about the effect of participating in the I-LEAD program on his leadership role and skills, he identified that this leadership training journey served as an *eye opener* and increased his awareness and confidence. It was observed in the following passage that presenting at a conference and sharing some of his good practices with I-LEAD's support was quite encouraging. He highlighted:

> I have noticed that I am just more aware of what I should be doing as a teacher leader in the school and trying to help people out. And, one thing that I have definitely done more of is I have done more regional stuff. We presented at the national NSTA conference, the physics teachers got together and did that... having that confidence to go and share ideas with those people was great and learning from that, and learning from them was terrific.

> We are going to be teaching a workshop in GSTA actually in a couple of weeks. And so those are things that I would never have done. I would have never had the confidence to do them not that I've seen a need like I see now so it's been very eye opening. It's been interesting.

John also mentioned that it was advantageous to participate in this learning community. According to him, the participants received various advantages including exposure to more resources. Also, they were able to share and exchange ideas without hesitation and model and discuss their problems within the group. When he was asked about his learning that helped him navigate the challenges he had, he asserted some of these beneficial aspects of being involved in the group:

> As before, I would have tried to do that myself based on my content knowledge. Now, I had 15 or 16 people that I trusted that I shared a lot of information with, and I felt confident to talk to. I could ask those people and say, *hey what do you think about this, is this a good idea or not, what kind of things should or do you think we should be doing here*- not just from my perspective but from theirs. So, it gave us a lot more resources in terms of people to bounce ideas off of and what was actually going on at I-LEAD. The way that they model problems, I thought was interesting because it was very much about the phenomenon first and going to the concepts and trying to build that idea. That resonated with me, and I'm trying to use it in the classroom but I'm also using a lot in MSP.

Another salient feature that significantly influenced this group was found to be the enhancement of the MTFs' awareness of professional identity of others and their own. With respect to this, Ashley clarified this impactful enlightenment and awareness in an interview from

archival data in February 2013 and then in the January 2014 workshop:

> Just hearing people talk in I-LEAD and figuring out where other people stand, other experiences people have, what's important to them, as we're all trying to develop this teacher leader identity. That has been really impactful that hearing from the project leaders talk about their trajectory into leadership and how things went for them, what went well, what did not... So the kind of teacher identity piece, what my identify is as a teacher is going to be very different than what other people's identities are, so how do I take those competing identities and figure out a way to merge those. I think that's the thing I've probably developed. The skill that I've developed the most in the past year is developing relationships with people and it's come through in the Noyce program and learning about what makes good science teaching, and if I'm not doing that and someone else is I need to learning to build off their strengths.

Before proceeding, and besides advantages of the project, it is important to note that amount of demands were found as a disadvantage factor for the participants. There were some complains about the expectations by the project team besides the participants' regular teaching and mentoring responsibilities at their school and family lives. John, for instance, touched on the applications of the demands and suggestions provided by the project team. He stated that they were not easy to handle due to some real circumstances, like lack of support by principals, the mentee's capabilities, limited resources, and so forth [October workshop 2013]. Similarly, Natalie, several times, verbalized about many demands on the MTFs' time: "we are overwhelmed right now" [March workshop 2012], and "that's just overwhelming – it's cognitive overload." [June workshop 2014]. The demands apparently put additional pressure on the MTFs; nonetheless in the meanwhile, it increased their skills, including time management, beliefs on

capabilities and success.

Overview.

The project staff helped the MTFs focus on the way in which defining goals and videotaping themselves might support them in analyzing their teaching practice. Thus, their aim immersed the MTFs with all aspects of the profession, such as being able to recognize the salient features (i.e., teaching and leadership vision, identity and attributes) of teaching (PV). It was believed that this method of assessment allowed these individuals to better anticipate the obstacles to realizing a change in the system as well as to formulate plans for overcoming those obstacles. Brad also highlighted that these critical incidents were designed for the MTFs to have such effective conversations. Thus, thinking about how to formalize certain practices helped them to think and perform better. These productive ways of thinking (PV) through discussions influenced their ability to see and define themselves and their leadership practices (PI) and thus helped them to improve their professional talents (TL). Teacher leadership requires a teacher to have and apply appropriate instructional designs. Their critical and constructive feedback helped them to design further actions in a better way and that influenced their professional vision. The feedback from others (MTFs and project leaders) helped them to improve their professional identity as seeing their own practices from others' perspectives.

Impacts of Teacher Driven Professional Development (TDPD) on Professional Vision and Identity and Leadership Characteristics.

The results of the study indicate that the discussions over the workshops helped the MTFs understand their potentials. This was evident from the participants' experiences, conditions at school and district level, their abilities, and most importantly the impact of I-LEAD on the MTFs. In this section, teacher driven professional development (TDPD), a school outreach

activity, is discussed to comprehensively understand the evolution of teacher leadership activities, professional vision and identity. Therefore, the following elements are presented as follows: the MTFs specific roles in the MSP activities, challenges, lessons learned, advice for those who plan outreach activities, advantages to do outreach activities out of their schools, and constraining circumstances. Most importantly, this section provides the MTFs insights about the ways outreach activities assisted them in performing as teacher leaders outside their own schools.

John: "It is easier outside of the school... keeps you moving and keeps you thinking".

In spring and summer 2014, John worked with a MSP program that he organized for approximately 20 teachers, mostly middle school teachers and a few high school teachers, at different schools in his county. The goal of this program was to extend the middle school teachers' mathematics and science content knowledge along with lab ideas and assessment strategies. John was responsible for creating and teaching physical science activities every other month in spring 2014 and for a week during the summer 2014. He delivered several innovative activities (i.e., mystery circuits, microscope phone, diffraction glasses, LED boats, colored shadows, shake it up, airplane and car build, etc.) to expand the participant teachers' physical science content and pedagogical knowledge. He took advantage of some useful YouTube videos related to the content to create more efficient instructional strategies so that learning could be made more interesting. As a teacher leader, his roles in the program were to create ideas/activities, discuss with the leadership team and facilitate the activities. As he explained his role and the preparation process, he shared significant details on his likes (creating ideas/activities) and dislikes (strictly assigned roles) as a teacher leader. The following excerpt from an interview [January 2015] also confirmed and explained his hesitation to take a formal

leadership position in the school (as discussed in the previous section - perceptions on teacher leadership). He elaborated,

> I'm more of the producer. We basically sit down and say, *here is what they want to know about, here is what they want, they want more labs for instance on energy or work or looking at forces*. Then, I try to come up with things that are not necessarily outside of the box, but that would probably be outside of the box for them. I try to create some activities that they can learn from and create activities that they can use in their classrooms... A lot of their training was in pedagogy and not necessarily in content. So I would say that is my role, I come up with some ideas. It's nice for me because I like the creativity of it. No one is telling me that I have to do this kind of lab or this sort of thing.

During the interviews (in May 2014 from archival data & January 2015), he shared many aspects of his TDPD activity through the MSP program. He demonstrated the challenges and advantages of conducting such outreach activities for other teachers. When he was asked about the challenges he faced across the activities he organized and facilitated, he shared several logistical aspects that he encountered. The challenges included: a) lack of importance to the participant teachers' lack of content knowledge, b) improper/ inappropriate use of teaching materials, c) lack of mathematical skills, and d) other misconceptions of the participated teachers. He also stated, "The first challenge was content they needed, so I think that they weren't comfortable enough with the material to know what they knew and what they didn't know. Logistically, the hardest thing." Also, he claimed the planning was tough because "it was, this is what we need to cover but we've got so much to do. They [participant teachers] want to know so much that is hard to touch on everything and the depths that we needed to touch on." He was also reflective on that challenging preparation process and he openly criticized their missing

points: “We probably need to get a little bit more interesting and not just do vocabulary. So getting them convinced of that was tough.” This assertion illustrated his evolving professional vision in terms of noticing inconveniences and making plans of action for the future events.

Besides challenges, he also talked more about the advantages of doing such outreach activities and involving with other teachers in different environment(s). He obviously highlighted that his awareness on his personal and professional identity and professional vision through questioning self and self-practices and interaction with different colleagues increased. He believed, “You don't have that conversation when you are talking about it in class.” He deeply asserted the measures he took to understand himself with the help of questions and conversations with the teachers who participated in the activities: “Why do I want to hear this with them? or Why do I want to share this with MSP people? It deepens your understanding and it deepens your understanding of why you're talking about it.” He further explained the difference of this teacher leadership role from mentoring and his reconsideration of his PV:

> It's interesting to step back from it and look at why do I not want to put this here, why do I want to talk about it this way, what goal, what am I trying to get out of it, what outcome am I looking for from students. You don't have a conversation when you're just teaching, and so when you leave the workshop you're trying to express to them, *hey I think this is important, and this is why I think it is important to put here*. And, rarely you have that conversation in class or with your mentee.

Similarly, as he already said in previous section(s), he liked to interact not only with students but also with adults - other teachers. He also touched on the same advantage(s) of collegiality when he spoke about the beneficial aspects of the department meetings at his school and I-LEAD discussions. He was quite eager to discuss about his and each other’s teaching

practices with experienced teachers. He believed that this discussion with experienced teachers would enable him and other teachers to notice and find solutions for problems or shortcomings from diverse perspectives. He also believed that their advice would be mature enough as it reflects from their years of experiences. According to him, this discussion could help him in a better manner to find himself, like where he was now in the process of teaching, mentoring, and teacher leadership. He stated, "Most important things are you can't do those things without getting better. Anytime you share something with somebody else you understand it better yourself and so when you're thinking about why this is important to pedagogy." Thus, this interactive method of sharing and questioning process brought another advantage, such as motivational thinking and moving ahead. As John stressed, TDPD activities "keeps you moving and keeps you thinking" [May interview from archival data 2014].

John's involvement in creating, organizing, and delivering content and pedagogical knowledge made him to feel more responsible for others' learning. At the same time, dealing with experienced teachers' thoughts and increasing their awareness on their shortcomings was tough for him. But, it appeared that he figured out how to give feedback and helped them to change something that did not work. "I try to be humble about it and say, *hey we are all just teachers here...* and just share some ways in which we can overcome that." This statement also reflected his leadership style in terms of having them share a egalitarian identity with him. In addition, he argued about a very important liaison between mentoring, leadership, and his role in the MSP. He saw himself as a change agent rather than directly as a leader within this process. He also compared mentoring and leadership and connected his role here as a form of an informal leader. He stated,

[I]t's more leadership in the form of mentoring... It's a leadership role in the way of

sharing other ideas with other people. I wouldn't say that it is a direct leadership role. I'm in not way their boss or anything like that. I just happen to lead those sections.

While he asserted being a *change agent*, he made positive comments about the group he was involved in. They were ready to change something in the necessary areas. He further claimed, "When something makes a big enough of an impression on someone that they find value in it and are willing to change what they have been doing for 30 years, that's cool, I like that." As an evidence to show they really would like to or already started to change, John explained that they were very good at sharing what they had tried and came up with and also volunteered to share some good ideas/practices with leadership team in the GSTA conference. "We are proud of them for doing that because for a lot of them that is really stepping outside of the box." John enjoyed being a guide and inspired other teachers to be agents for change and consequently teacher leaders through encouraging them to think outside of the box.

To be able to be an influential leader on other teachers, their learning attitude and positive interaction were critical elements for John. Thus, this interaction enabled him to try creative ideas that eventually helped John to rediscover his own and other teachers' capacity and talent in terms of learning better through innovative ways. John explained, "The people I work with, they are not going to work against me. They are really good about jumping in and helping out. They are good about giving me that creative license to do things" and continued, "They were open to share, learn and ask questions right away, such as *I don't understand that that doesn't make any sense to me*." From his insights it was construed that an open interaction, good attitude and mutual respect were the crucial elements that enabled John to help and perform better with other teachers.

Another helpful element that helped John to become influential in this program [MSP]

was the availability of sufficient resources. John was free to choose or create activities without any consideration to limitations of funds. He stated, "Having the funds necessary has been really helpful because as a high school teacher you are limited by funds. Trying to do something with MSP there are a lot more funds available so you can do a lot more."

Natalie: "MSP forced me to think how might I approach what I do with different population".

Natalie worked in the same Math and Science Partnership (MSP) program with John. She delivered PD to approximately 20 8th and 9th grade physical science teachers. She facilitated professional development in her school district in spring (one day) and summer 2014 (six days). She delivered numerous innovative ideas/activities in physical science to improve participant teachers' pedagogical content knowledge. Her role as a teacher leader at the program was to discuss and create the sessions with leadership team and to facilitate the activities. As she explained, "We have done plain old teacher surveys... and looked at the nation wide CRCT scores for physical science and the EOCT scores." They looked at low strands and primary compelling areas of their students in comparison with students in other districts or states. She added in an interview from archival data in June 2014, "[A]t this point we have also straight up hit things that they [participant teachers] have avoided."

Before Natalie's involvement in these TDPD activities, she thought of doing some outreach activities because she realized that there were not enough people on board to discuss the shortcomings, needs, and demands of teachers at her school. She elaborated on this in the March workshop in 2012,

> I kind of feel like I'm being outsourced on those days. I just think that we could definitely find a more productive way to use... like teacher-driven professional development. You

know, maybe doing things, or presenting things, or sharing ideas within content groups, or, you know, even vertical planning.

Gary (a project leader) reflected upon her future initiative plans and explained why they, as I-LEAD project staff, wanted to have strong relationships with their [MTFs] districts: "You determine opportunities or experiences that you want to have in place at your schools – or across schools – that we've got an advocate for it, or a liaison or a facilitator." Natalie was quite appreciative for the support provided by the project team. In an interview from archival data in June 2014, she approved that she needed encouragement and support to carry out her outreach plans. Even though Natalie believed herself in her capacity to take leadership and accomplish her goals, she expressed that she needed a pushing partner. She stated,

> Having leadership would definitely help me and benefit me. Because I have so much on my plate, at this point in my life I need an accountability partner, I need Gary to call me, text me, bug me, and email me. I need that accountability to make sure that I don't fall off track.

When Natalie spoke about her MSP activities, she explained her instructional strategies in detail. She did opening activities and conducted discussions on the topics (e.g., tests, data, and teachers' needs) as a group together. Then, she took an instructor role and gave them instructions on what she wanted them to do. As they were completing the tasks, she asked probing questions, facilitated the conversations until they ended up with clear conclusions on discussions. She defined this process as, "just basically using leading and guiding questions." She further identified her role during the instructional time: "I take on the roll of co-teacher helper. I walk around and answer questions and help them out... just like I would do with the student in my own classroom." This statement illustrated that although she was interacting with adult learners,

whose interactions and learning methods were different from her students', she did not express any interactional/communicational challenges within this learning community. Contrarily, it seemed that she transferred her leading ability from classroom to this group with relative ease. Moreover, she took advantage of involvement with a new group of teachers, including teachers with a diverse level of experience. To sufficiently help this group, she pushed her instructional and leadership limits to maximize her potential. She shared a very significant statement: "Working with MSP has helped me; forced me to think about students that aren't my students; how might I approach what I do with different populations." Her view was quite similar to John's assertion about the outcome of working with different groups of teachers, as he asserted, "It is easier outside of the school... It keeps you moving and keeps you thinking". This way of Natalie's thinking demonstrated that she, like John, began to see things differently and act differently with the adoption her skills into the new group of learners. This statement also reflected her changing professional vision and leadership identity that were reconsidered and reconstructed during the interaction with the new (other than her school) learning community-MSP. Natalie shared those challenging areas, which were only logistical challenges to her. In her first year of the two-year program, she had used her best activities that she felt confident to present. However, the new reform-based instructional strategies made the second year harder for her. She stated:

> The challenge with MSP is continuing to modify and innovate and be creative and generate, and beyond that I have to get the teachers to take ownership, that's one of the goals. So, you have to figure out how to get them to do that. So, those are the logistical challenges.

Besides these compelling areas for her, she also touched on other common challenging

point such as time limitation or time management issue. She complained that all the roles she played every day together (as a wife, mother, teacher, mentor, doctoral student) were tough to handle. Although she was struggling with balancing her different roles in relation to her personal and professional identity, she did not see these as problems, but as she expressed, "they are one more slice out of your day" [June interview from archival data 2014]. Nevertheless, she claimed that the other roles took enough time out of her day and thus prevented her from exhibiting her leadership skills efficiently. As discussed in the previous sections, she was eager to take additional roles that would benefit other teachers both in her school and out of her school. She articulated that she was ready to learn and experience more to be an exemplary teacher leader. With respect to her insights, she advocated that she reversed a circumstance that purported an obstacle into a gain. As she was grumbling about the time limitation due to other accountabilities, it appeared that she figured it out in a way that she could transform relevant skills into her leadership performance. She asserted,

> I think that involvement in other things at times may appear to affect my leadership at MSP but at the same time I think I am gaining things at these other experiences that I am bringing back to MSP, so the same challenges that are taking away from it are also giving back to it in another way.

Natalie further explained her evolving leadership approach and her professional vision. She stated, "I progress through that [TDPD] opportunity that I started to think more about how do I help them see things differently, advance their pedagogical content knowledge." [June interview 2015] This rationalization demonstrated the link between the parallel development of her PCK and PV. As she expressed that her initial focus was only delivering the content, but she focused on towards the end, convincing the teachers to see the value in the reform-based

pedagogies that they could take it back to their classroom.

Her leadership was not the only notion that was improving with her. Natalie—unlike John — desired to be a *nucleus of change* of others' career. She was aware that as she was evolving her leading ability, she could be an inspirational person to have other teachers notice and gain their leadership talent as well. As speaking about the preparation and discussions in the leadership team in MSP, she stressed that participant teachers "must come up with some activities, then they give us a supply list, then they implement it for the group, then we talk about it as a group." This statement showed that she tried to apply the same methods of the I-LEAD program. This picture also reflected that she was able to implement some useful ideas from the I-LEAD project leaders, as she claimed she was going to use. She stated that the participant teachers become able to change their own teaching and impact other teachers in terms of generating, sharing out innovate activities." In addition, she highlighted her enlarged perspective that was creating teacher leaders: "I want to continue to be a driving force within my district and to try to help other community teachers to practice differently to begin to try develop themselves as teacher leaders." [June interview 2015] Based on this statement, she was enabled to see her role(s) in this group with broader perspective and reflected her internalization process of what she had learned from her training program.

Ashley: "I'm a contact person and resource for them".

Ashley worked with a MSP program that was organized for approximately 20 elementary school teachers at different schools in her county. She actively worked and conducted several activities for the participant teachers in this program during spring and summer 2014. The goal of this program was to increase the elementary school teacher's mathematics and science content knowledge. Teachers in this program completed four courses to earn a science endorsement on

their certificate. Ashley was in charge of teaching physical science content and inquiry skills to these elementary school teachers once a week in spring 2014 and for a week during summer 2014. She delivered numerous reform-based ideas/activities (i.e., scientific method-popcorn-lab, forces-friction-motion along with PhET simulations, and waves-sound-light along with Ruben's tube, sound labs, and lens simulations, etc.) to increase the participant teachers' science (in physical and nature of science) content and pedagogical knowledge. Similar to John, she also enriched her instructional strategies with some useful YouTube videos related to the content being delivered. As a teacher leader in the program, she was in-charge of creating ideas/activities, setting up lab activities, discussing with the leadership team, coordinating field trips, and facilitating the activities focused on physical content. She worked with the project leadership team in building sessions, brainstorming ideas, and modeling innovative [tried and approved by her] activities. Her primary intention was about helping the teachers integrating some math and science together more closely, and addressing student misconceptions.

When she attended the MSP program, she initially believed that she was seen as an *outsider* and a *scary person* as a high school science teacher. However, towards the end of the program an interview from archival data in June 2014, she claimed, "[W]e were doing some of the field trips and some of the classroom participation, it was more me getting with them and helping them design and be more apart of them instead of being this stand off instructor person." Further, she defined her role, which was modeling: "I am going to contribute like a member of their group and so hopefully that will also help keep the ball rolling if I am in there modeling for them what we are supposed to be doing." Most importantly, she saw herself as *mentor*—like John—in this process in extending the teachers' content and pedagogical knowledge as well as encouraging them in expanding the community. She stated, "trying to figure out how add more

to my plate and do it all in an effective mentor."

By means of the interviews (June 2014 from archival data & February 2015), she described several facets of her TDPD activities through the MSP program. She clearly asserted some challenges she faced and the advantages she obtained through such outreach activities. In the interviews, she was asked about the challenges she faced across the activities she conducted and delivered. One specific challenge among several others for Ashley was dealing with attention seeking people, specifically one of the participant teachers, "who wanted to talk all the time and so it was hard sometimes to redirect the conversation when I was annoyed with that person." As she explained she also pointed out her weakness, which was being impatient in handling tough people. Ashley felt frustrated with this element. She knew that her impatient attitude must be changed: "I had to be much more patient with them than I expected and sometimes I would get frustrated. I would say, *Why don't you understand this.*" It was more compelling for her and for other to work with this type of people (who cannot quickly get the point or distract others' learning). Hence, she tried to navigate her and other teachers' relationship with that person. She was working on "how do I help facilitate so they are not the outcast who doesn't have any friends to sit at their table or whatever." After three years of attending I-LEAD program and being a department chair, she seemed to come up with some strategies in coping with frustrating circumstances on the sly. She also expressed that during the workshops in MSP, she was "walking into the stock room to get more supplies so that giving 30 seconds mental break, taking a deep break, and relaxing for a minute." She believed that this method helped her in hiding her frustration on others. As a result, she said, "[I] ended up giving up some of my free time when we had a break or when we had lunch" to talk with participants. Even though she was not necessarily interested in a topic, she encouraged them to share and later

on to redirect the conversation: "*That sounds like a really cool story, why don't we talk about that at the break? I would like to hear more about it*." According to Ashley, her devotion of her break/lunch time to communicate with the participants produced two benefits for others: (a) feeling special, not isolated, and (b) giving more attention to the activities/assignments over the workshops. This also helped Ashley in delivering the courses easily and effectively. With respect to this, it could be said that she figured out to handle some challenges (reversing bad conditions into beneficial points) and to keep people on task, which are significant components of teacher leadership.

As challenging factors, Ashley shared some other hindrances that prevented her from exhibiting her leadership characteristics in this group. She was trying to figure out: (a) time management issue as spending hours in preparation and delivering the ideas besides her other roles in her own school as a teacher, mentor and department chair; (b) incorporating science standards into elementary school level standards (but using the outline of the standards given by the county was helpful for her); and (c) not being familiar with elementary school students to enable them to understand and address their misconceptions for better conceptual understanding. As part of the leadership team of the program, she suggested these issues for consideration in the next MSP program(s). This exhibited her leadership characteristics in terms of noticing shortcomings and making suggestions for the program and also for her own practices that reflected her evolving PV.

Ashley's other challenge was to deal with the fear of science for the elementary school teachers and keep those teachers engaged with the science activities. According to her, their fear came from lack of science background, thus they avoided doing more science related activities at their schools. However, Ashley was aware of their science activities as she had seen it in a

school where her dad was a principal and a former elementary school teacher and from her elementary school teacher friends. Ashley mentioned that sometimes at elementary schools the teachers do not teach science and may increase students' misconceptions [These were also the reasons why she preferred to work with elementary school teachers for the MSP program]. She argued, "I thought that this would be a good way for me to interact with teachers and in the content that I enjoy, also really impact what our younger students are doing." She further elaborated,

> Working with elementary teachers is different than working with high school students in some ways, but also very similar. Just trying to overcome this fear of science, they don't have a strong science background, they are trying to figure out how do I teach this and I don't really know it... So, I am trying to figure out the best way to teach them. So, most of what I did is to present content and some kind of lab experiences and then we talked about it and talked about how they could use it to the classroom.

The constraining factors discussed above helped her to improve her leadership skills, professional vision and professional identity. Over the MSP workshops and further communication with the group, Ashley evolved her leadership skills like communication with adults [teachers], time management, and being patient in building her capacity and of the group. When she was asked to describe her leadership skills, she answered, "I worked on my communication, I figured out how to effectively communicate with other adults, so that is definitely a skill that I have developed, and time management." Time and communication issues were challenges for her; however she believed that these two components were significant to be a good role model and a leader. Thus, she was working more on organizing her time and moderating her interaction with adult learners [teachers] as efficiently as possible. Similarly, as

to her communication skills, she asserted that being patient and thinking in small scales were the elements that she should consider to make changes. These elements also helped her in building capacity for the group. She was seeking the best ways and reflected on this as follows, "how do we do it in our school and how can I take that and present it out to the county, or how to present it out at like a GSTA conference." This statement showed her evolving PV in terms of seeing her practices from broader perspective and reconsidering her further leadership actions. She expected that other teachers could get few other people on board. In her explanation of what she meant by saying building capacity, she also clarified that she did not intend to create other teacher leaders as yet. The following passage illustrated her leadership identity in terms of seeing the context of particular circumstance that was the aim of the MSP program was not creating or growing teacher leaders. She stated,

> It's about building capacity and like starting off with just a small handful of chemistry teachers and kind of pulling people in slowly. But it wasn't by any means developing them as a teacher leader, what is science specialists or whatever as much as I wanted it to be.

It was apparent that she had the capacity to maximize the potential in others although producing other teacher leaders was not her priority at that point. It was a very significant point that Ashley defined herself more of a contact person and/or a resource for this group of teachers. She seemed to step up to the plate to provide additional lab materials and her time to answer their questions and give feedback and advise on their innovative ideas. She further stated,

> [W]hat I did and am going to continue doing for the leadership is being a contact person for them... even though the program is over they can contact me to borrow lab supplies, and get lab supplies to get things set up in their classroom, I'm a resource for them.

Overview.

As the data illustrated above, all MTFs reached the point of feeling like a teacher leader that they, particularly John and Natalie, did not feel at their own schools through the MSP activities (see the following section). Their insights on gained skills over the TDPD activities echoed effective teacher leadership. These outreach activities helped John reconsider and reconstruct his: (a) creative side of teaching and leadership and transformation of collaborative and interactive effort to help others (TL); (b) professional beliefs, knowledge and self-image (PI) through challenging and successful experiences with other colleagues; and (c) understanding and noticing the potential roles, functions and practices of teacher leaders (PV). Natalie gained ability in: (a) overcoming some relational obstacles, developing positive interactions with her colleagues, and switching view on seeing herself as an *inferior* at her school to a more effective teacher leader; and (b) noticing her and others' practices out of box (PI) and planning better actions (PV) to inspire others for change and leadership. Ashley emphasized that the activities increased her (a) awareness on her and others' need and staff development, (b) self-confidence and interests, like "some sound pedagogy at elementary schools", and (c) realization of lack of points of vertical shaping/teaming and communication that she was still working on. Lastly, practicing leadership out of school helped the study participants to find where they were in their leadership journey, where they desired to be, and what areas need to be improved to reach their targets on the leadership trajectory. Further, all MTFs had a better sense of their capabilities (PI), what other roles beyond the school demands from them, and what is valued in the particular social/professional group (PV).

Other Breakthroughs: Powerful Factors on Teacher's Leadership, Professional Vision, and Professional Identity Growth.

Teacher leadership is examined in this study within teacher leadership training support and teacher driven professional activities. However, in order to comprehend how the participant's leadership trajectory and their professional vision and identity were rationalized, some other major influential factors should also be considered. As the participants of the study had been experiencing this journey out of their classroom and schools, some other components were also found to be influential on their evolvement and performances. Each MTF had a different level of leadership capacities and styles. They also varied in their personal characteristics, strengths and weaknesses, administrative supports, school culture/structure, interactions with their colleagues and principals, graduate studies, and even the books they read. The data illustrated that all the components cited above were significant to understand whether these components enhanced or hindered the MTFs in exhibiting their leadership effectively and (re)shaping their professional vision and leadership identity. Thus, in this section, the data were presented and discussed to understand how those significant components played a role in the MTFs' perceptions of their leadership roles and characteristics and professional vision and professional identity.

John: "My strength is my understanding of it".

After over three years of participation in the program (I-LEAD), John mirrored his experiences and provided other significant breakthroughs that influenced his leadership performance as well as his professional vision and identity. He trusted his knowledge (content and pedagogical content knowledge [PCK]), but leadership requires more than a strong professional knowledge, as he became aware of it. To illustrate John's leadership performance,

some other salient influential factors that varied with his personal attributes, interactions with his colleagues, support by his school and other teachers, and literature that John read were examined and discussed as follows.

The first significant element was his personality and relatively his personal strengths and weaknesses that influenced his leadership development. In an interview from archival data in February 2014, John shared his thoughts on what other people might think about him and stated, "Some people think (like Gary) I am aloof and like I don't care about what's going on, but I don't feel that way. I am trying to be less aloof." According to him, he had been trying to be helpful and be a key person. John stated, "people may think I would not care, but I really care and try to help." One reason might be as he asserted that he likes humor, and "it's maybe negative trait of mine." He expressed that he is not careless and revealed that he cared about his colleagues, especially when they struggled and needed help. He asserted that he likes to relieve people/his colleagues around him when they get stressed.

During the February interview from archival data in 2014, he further described his strengths. He identified himself as a creative, organized, confident and innovative teacher and leader. He believed that these are the strong attributes that were required for effective leadership. He liked doing interesting things that his colleagues like and did not like to insist on doing the same things. He was also working on improving his communication with people and organization of his work to be a *change agent*. He stated, "but I should be more reflective and reactive about changing things." In terms of his confidence level on his profession, he claimed, "I am confident about what I am doing, but change is difficult… especially changing audience from students to teachers...it's not really difficult, but perception in my mind is difficult." He firstly wanted to change and/or reform his beliefs and perceptions on his leadership identity and

vision; however, he expressed that it was challenging. He was well aware that change begins with thoughts and perceptions followed by actions. Within the process of leadership development, he recognized what he struggled with first (i.e., audience: students vs. adults/teachers), particularly during the conference presentations. Though he served as a department chair at his previous school, sharing good implementations as he advocated was not enough without practicing presentation and gaining self-confidence on his knowledge and skills. He argued that his confidence level was sufficient to be listened to and respected. As he asserted in a written reflection from archival data [in 2013], "I think word gets out that you have a good head on your shoulders and people respect you." Then, he extended this during the interview from archival data [May 2014]:

> [B]ut I wish I had overconfidence to make people something do (like my big brother, and Gary). I think it's a great thing to have. But it's different when you present to someone else rather than students. If I have not done it before, it's different. Like at GSTA, I was OK, but could have done it better.

In order to clearly understand John's evolvement of leadership identity, he was asked again about his strengths during an interview in January 2015. He emphasized (a) his emphatically thinking, and (b) making learning permanent by making the ideas simplified when necessary via understanding what others' needs, demands, capacities, and capabilities before sharing roles and across the application process. He claimed, "My strength is the tendency to be able to pull back and be fine." Further, he elaborated,

> I have been pretty self-taught. And so I think that drives me with people. So, I think that is my strength is my understanding of it, trying to make it simplistic is what I do best.

> And trying to make it visual, and trying to make people be able to see what is going on, and why does this change.

During a February 2014 interview from archival data, John was asked about the personal characteristics that he believed had allowed him to develop these strengths as a teacher leader. He ended up his beliefs in a way that illustrated his leadership identity that was closely related to his personal identity. He avowed, "I don't worry too much and I think I am able to logically solve problems while being personable and trustworthy." With this statement, he emphasized his leadership style that is relied on trust, transparency and collaborative problem solving. He then enhanced his beliefs during the January interview, and stated,

[I]t's important that you focus on the strengths but you need to work on your weaknesses as well." He advocated that the weakness is the tendency to get *stagnant* and to get *apathetic*, so "you have to constantly be getting better at those things.

He also touched on a very critical point and stressed that people were easily influenced by other's weakness in the same way as other's strengths. The passage that follows reflected his constantly advancing professional identity in terms of noticing the reflection of his weaknesses that he needed to put afford on developing. He particularized,

> We certainly have an area in which we can grow. We might not be the best at it when we're done growing, but at the same time we have got to address our weaknesses and operate from an area of strength. And constantly be working and growing. We will never get sick of the phase of lifelong learners. If you have weakness the students are going to get that weakness as well. They are also going to be weak there.

The other significant element that prevented him from maximizing his leadership performance was his interaction with his colleagues at his school versus at other groups (i.e., his

previous school, I-LEAD and MSP). To him, group interactions were crucial in terms of embracing pros (i.e., taking advantage of encouragement, respect and trust) and cons (i.e., dealing with time and bad attitudes of teachers) thus affecting his leadership performance. It was John- an experienced teacher, mentor and former department chair- who shared his frustration in terms of his communication with his colleagues at his current school. As it was described more in detail previously, he had limited and/or undesired interaction with the teachers because of limited time, workload and others' careless behavior to him. He said,

> I spent most of my career in the south part of our county where the demographics were much different than they are at my current school. I have let frustrations relating to this inhibit my growth as a leader. While that was happening, I ended up slipping into a role that doesn't promote change. [written reflections-2013]

However, his interactions in his current school was very limited due to a common reason- workload in a high school- as it was discussed in the previous sections. He explained, "[The interaction] is strictly professional. It's very superficial... I don't feel close to my colleagues I just feel like we're in a professional relationship to say hey how you doing, good morning." Since him and his colleagues rarely saw each other during the day, he felt he was not able to exhibit his leadership skills and knowledge, e.g., in sharing ideas. Otherwise, he seemed to be very satisfied with his interaction with other teachers during MSP activities. Those teachers whom he worked with during MSP positively influenced his beliefs on his professional vision and identity. He developed more confidence in his leadership capability and talents that impinged his leadership vision and identity. Relative to this, he further stated another important component of effective leadership, which was creating a positive learning environment to comfortably express opinions. It appeared that he achieved it. He said, "Communication has been

good. They respond well to me. They are engaged... and they trust us to not make them feel bad if they don't know something. I think our interaction as a group is pretty open."

One of the most essential elements in a teacher leadership journey is the support by the administration/principal. John expressed that he could not get the support of the administration/principal. In the written reflections as response to open-ended questions [in 2013], he stated that he was heavily involved in the decision-making process at his previous school. He mentioned, "I assume that the quality of my work at previous jobs made the principal approach me about that position." On the contrary, he did not volunteer to be an agent of change and reform in his current school as he did not get enough support both from his colleagues and the administrators of the school. He stated, "I have a tendency to pull back into my classroom and make it all about my class and not seek to change things in the school." It was noticeable that lack of support by his school influenced his leadership vision and identity through empowering him made no headway. He further spoke about closing that supportive gap with I-LEAD group and consequently the teachers of his school. He was appreciative of the support by the project team, as he could not find that in his current school. He wrote in the written reflection, "I desperately needed the push that this program has given me. I need to present more and share out ideas more. This program and the people in it are helping me do that."

Reading additional sources other than only instructional foundations also had a great impact in terms of realizing and restructuring his leadership sense (PI) and goals to perform as more effective leader (PV). These literatures were very influential breakthrough factor for him and enhanced his perspective on improving leadership vision and identity together with efficient leadership characteristics (i.e., *QED: The Strange Theory of Light and Matter* and *The Science of God).*

Natalie: "The book made me realize that I need to wait to speak".

After over three years of her participation in the program (I-LEAD), Natalie shared her experiences that showed some other significant breakthroughs that influenced her leadership performance as well as her professional vision and identity. The elements that helped or hindered her leadership performance and also that varied with her personality, interactions with her colleagues, support by her school and other teachers, the books she read and the practices she learned through outreach activities were examined and discussed as follows.

The first breakthrough element was her personal attributes and relatively her strengths and weaknesses. In an interview from archival data in October 2013, she defined herself as easygoing, conformist, helpful, and energetic person. She stated, "I am very outgoing person; I like conversing people a lot. I have also a very forward personality, so I think I tend to kind of help people... people always know how I feel about things." She also stressed, "I think I am caring and… try to be approachable and be somebody that tries to help others when they need help." The way she identified herself accord with her leadership identity. She reflected her entrepreneur [teacherpreneur in her case] spirit and also narrated her likeness to reach out to people when she recognized they might need help related to instructional venues and/or communicational issues. These characteristics led her to do outreach activities for other teachers as discussed in the previous section. She continued with other important personal as well as leadership characteristics that required more experience and practice to mature: "I handle stress pretty well, I don't get nervous or anxious about things if I do usually"; only, "if I am going to present at a workshop or something, then I'll be nervous." Her nervousness was about the different audience as she was quite concerned about the possible criticisms/challenges she might face. She was also worried about the audience behavior like authoritative or unwilling

participants rather than willing to absorb what she was delivering. Thus, the climate of the audience group could easily obstruct her leadership performance as she also stated in June 2014 interview from archival data, "then maybe I wouldn't be as a leader." Thus, understanding the audiences' emotions besides knowledge level became her priority to enable to help them and to exhibit her leadership skills more efficiently. This also evidently showed her changing leadership vision in terms of noticing herself and others' thoughts and possible reactions unlike students. In addition, she asserted her other significant disposition, which directly reflected her awareness towards change that forwarded her in evolving leadership identity, vision, and talent. She stated, "I like to create things, come up with new ideas and my own activities or take people's activities and make them better. I'm always looking forward to new things… I guess I am constantly changing, constantly learning."

With this respect, Natalie believed that in the context of teacher-leadership, it matters what people think because a teacher leader has to get teachers to follow her/him. So, it was important for her to know others' thoughts to revise her methods to address others' needs and sharpen her pieces or shortcomings in the context of personal and leadership identity that relatively changed her leadership vision. She also claimed, "you should be aware of what people think so that you can improve on some things that people might not view as a positive quality or something like that."

In the process of revising and reconstructing her leadership components through her rising awareness, Natalie stressed how a book titled, "*The Multipliers,"* changed her professional vision through viewing her practices from different perspective. This book was offered as a resource to her by an I-LEAD project leader. Before reading this book, she reflected, "I probably unintentionally shut people down before" by "dominating the conversation and by

overemphasizing my own ideas." As she stated above, she had a *forward personality*; however, "the book made me realize that I need to wait to speak and that I don't have to say everything that's on my mind." She asserted that she figured out the benefits of stepping back and giving others the opportunity to contribute to the conversation. Thus, she believed that this way reshaped others' opinions on her and also positively influenced her leadership performance. She also felt more confident and validated. Through this book, she felt enlightened and learned to handle people and build relationships. As she asserted, "That's [revising her leadership behaviors] probably the biggest thing and I've tried to do."

It was Natalie, who used to care a lot about others' thoughts about her, specifically in her school. Her perception about her colleagues' thoughts at her school was obviously keen and discouraged her from taking more leadership actions (i.e., taking roles, sharing new ideas, organizing workshops for her colleagues) at her school. She was enthusiastic and eager to share, but did not think that people would respect her. To her, the biggest problem was "jealousy" and that led to hesitation to offer some innovative ways of teaching and learning for both teachers and students. She used to think that she was an *inferior* teacher at her department and the doors were always closed for her; she felt isolated at some points due to her graduate study and participation to the I-LEAD and MSP programs and conferences. As she stated, "[I]t more difficult for me to be seen as a teacher leader within my school and in my department." [June interview from archival data 2014] At the same time, her TDPD practice was another biggest influential factor, which influenced her leadership identity. She began to believe more in herself (PI), practices (PV) and skills (leadership talent). After the MSP activities, she gained more confidence and her beliefs on her leadership identity and relatedly her leadership vision have dramatically changed. She stopped developing inferiority complex anymore; instead, she had a

voice in her department. She elaborated her paradigm shift about the dynamics at different groups after realizing her leadership capabilities through reading the book and specifically practicing during the outreach activities:

> I felt very defeated like I couldn't do anything, then after my experiences with MSP and seeing that people do have respect for me. I think I used it as a spring board to go past my department head and I went straight to administration and talked to them about my ideas... I have learned that that doesn't mean that all the doors are closed. That's why it is different; it is just a different dynamic. [June from archival data interview 2014]

Ashley: "I feel pretty lucky, my school gives us a lot of flexibility".

Ashley, after over three years of her participation in the I-LEAD, reflected on her experiences and relatively other significant breakthroughs that influenced her leadership performance as well as her professional vision and identity. To be able to exhibit effective leadership, some other salient breakthrough elements as strong influential factors that varied with her personal characteristics, interactions/communications with her colleagues and sincerity, support by her school, and networking were examined and discussed as follows.

In an interview from archival data in February 2013, she obviously demonstrated the personal aspects that influenced her leadership performance, identity, and vision. She also demonstrated the role those aspects played in helping or hindering her leadership performance, identity, and vision. She provided her perceptions on her personal characteristics that she exhibited depending on the various platforms from both her and others' lenses. The following quotes are examples of her perceptions representative of those different platforms: (a) in classroom, "I am fun, kind of joke around a lot in my room, I'm sarcastic and can kind of poke fun at them and they can poke fun at me"; (b) in school, "I'm a pretty vocal person. I express my

opinion, but I'm also willing to get my hands dirty. I try to volunteer my time and get in there and fix it"; (c) in I-LEAD, "I kind of sit back and absorb everything... I've also learned to do a lot of internal processing, *what this person said and where does my idea fit in here and how can I contribute*"; (d) in MSP, "I'm very patient with my students... but with adults that's the impatience piece. My personality is like a go-go-go, take on a lot of stuff, don't stick with any one thing for a long time"; and (e) in general, "I really like challenges and I like things to change, I'm not one of those people that wants to do the same thing all the time... it's an impatience with myself."

There are two significant ideas embedded in those passages. The first is that Ashley had specified her leadership behaviors and modified skills according to the audiences/groups. In this respect, she was joyful to her students, assertive among her colleagues, more quiet with the I-LEAD group, and an impatient change agent while guiding other teachers. During the workshops, it was obviously seen that she usually preferred to wait until the conversation has gone for a while before adding her thoughts. The reason was that she was well aware of her personal characteristics and knowledge, thus wanted to give others time to first share. As she stated, "I can be kind of bossy and opinionated... so I've learned to take a step back and welcome other people's ideas." But based on the group dynamics, she showed different sides of her. In I-LEAD group, she, as a participant, listened to others' experiences and opinions first and then contributed to the overall conversation whenever she found it necessary. It was, "sometimes a comfort-confidence beast too, more so the chemistry-physics content, the science content than when it's interacting with other people content." Since other MTFs were master teachers in their areas, she felt she was not the only expert in the group. Notwithstanding, her leadership role was very vocal and had more control to redesign her instructional and/or leadership style in her

school and TDPD activities. For example, as she said that it was important for her to realize that they were also learners like her students and thus she felt her expertize in her area [June interview from archival data 2014].

Thus, it was obvious that her professional position in each case identified and (re)form her actions and performances; that was not inconsistent with her leadership identity, but her awareness of noticing and making sense of her professional self-concepts (PI), professional practices (PV), and adapting different groups considering different dynamics (TL). This processing also helped her in leadership identity formation, which was a complex phenomenon and grew with her background, personal characteristics, training and practicing.

The second significant breakthrough factor for Ashley's leadership development was her interactions with her colleagues. As data illustrated, she had positive relationships with other teachers, both in her school and MSP group, and was still working on improving those relationships. In an interview from archival data [February 2013], she stated, "[T]the skill that I've developed the most in the past year is developing relationships with people and... learning to build off their strengths." She related her ability to develop relationships to her department chair position since her interactional zone was extended through her formal leadership role. She stated, "I have a good relationship with the people in my school and we can have those conversations, and I think I'm slowly building those relationships at the county level, partially through being a department chair." She was well aware of the fact that building relationships takes a while. She said, "Once I build those relationships, it opens up the communication a little bit more." She claimed that through those interactions, her professional perceptions on her leadership identity and vision have changed. This enabled her to recognize her gaps and capabilities more realistically. Particularly, her TDPD activity was a good platform for her to practice and grow

her communicative skills with others and hence her awareness level of her leadership talents (i.e., building rapports). She had been trying to figure out how to navigate her relationship with different group of people/adults and their relationship with other people. Her outreach activities gave her some practice on how to accomplish that goal. Remarkably, she claimed in June 2014 interview from archival data:

> It helped me to figure out another way to communicate with adults, I feel like I am really good at communicating with kids and teenagers but now always with adults, and that's one of the areas that I really want to work on, so this just gave me more opportunity to communicate with adults in a different setting with different adults.

Nonetheless, developing more communication skills was her area of focus, as she asserted in February 2015 interview, specifically when she spoke about her weakness. It appeared that she was still struggling with handling with others' teaching and learning ideas and attitudes. She expounded why communication with people who had very different ideas from her was an area in which she still was in need of growing:

> My weakness is definitely still in communicating with people who have very different ideas than I do... Since we have very different philosophies about education trying to communicate in a way where we are both open minded and potentially could merge our philosophies about something have not been very good at. I feel like because of all of my experiences I know things that are best practices and the things that seem to work for everyone. People have different ideas. It's hard for me to be open minded about those ideas when I have this background that this is what they should be doing.

When she was presented with the statement "if you focus on the strengths the weaknesses tend to go away", she did not agree and said, "communication is so important that my variety of

experiences means nothing if I cannot get people to want to work with me. So, I have to be able to focus on my weaknesses and improved those." She also stressed the importance of sincerity and mentioned it as one of the significant elements of effective teacher leadership to make others pay attention and respect her ideas:

> If I'm trying to communicate with people in a way that seems a little fake then I don't think they would want to listen because I tend to be a little blunt. Trying to figure out how to challenge this is challenging.

The other significant breakthrough element was the supportive approach of her school; she said, "I feel pretty lucky, my school within the constraints it gives us a lot of flexibility." Although the county authorities shaped the curriculum, the way that teachers teach was totally up to them, particularly in her school. She described herself and her colleagues as a cohesive group of people who were willing to and able to suggest new innovative methods to implement. When they offered a new way, the principal's reaction was typically like, "all right, if you think it makes sense, give it a try and see if it works." Thus, she was able to try different ideas/methods/activities that nurtured her leadership practices and sequentially evolved her leadership identity, vision and faculty.

The other salient influential factor that helped her to practice her skill through outreach activities was *networking*. She, like John, had a good connection with their science supervisor at the county level. She talked to the supervisor about many other things, and he offered her an opportunity to be a part of the leadership team of the MSP program and conduct TDPD activities within the program. As she was asked what advice you would have for others, who worked on workshops [February 2015 interview], her first word was *networking.* Immediately after, she

clarified, “knowing who to ask for what is really important just to get your foot in the door.” This was also another essential component of effective leadership.

Overview.

As the data discussed above illustrated, John, Natalie, and Ashley demonstrated the components that were influential in (re)forming their leadership beliefs, abilities, identities and visions. There had been common essential elements (a) for all, such as their personal characteristics (along with strengths and weaknesses), confidence level, interactions and building relationships with their colleagues, school culture and support; (b) for John and Natalie, the influence of book(s), disrespect by their colleagues and lack of support at their schools versus MSP group’s positive attitudes and respect; and (c) for Ashley, sincerity, support by her school, and networking were other salient elements in her growth. All MTFs showed that their leadership skills considering these elements progressed with her evolving leadership vision and identity and/or vice versa.

Interwoven Interaction through the Trajectory of Teacher Leadership, Professional Vision and Professional Identity.

The set of insights presented above illustrated the overall picture. It depicts the evolution of the study participants’ leadership trajectory along with their professional vision and identity within different contexts. With that respect, there are several significant ideas pointed to the participants’ developmental process in their leadership journey. In the context of being a teacher, for instance, all three MTFs demonstrated that they were effective leaders in their classroom. Their teaching philosophies and practices were not only beyond traditional teaching systems, but also promoted change by taking additional roles out of classroom (Natalie: “wanting to be...nucleation point of change”; John: “ready to start being a part of changing that”; Ashley:

"I've started a lot of committees and volunteered to..."). In addition, the MTFs were at different levels of analyzing their professional identities and practices by experiencing mentoring and other leadership activities that they carried out in and around their schools. As they experienced other roles (i.e., mentoring, serving school committees at different aspects, such as a department chair, peer coach, presenter, etc.), they were also supported by the I-LEAD program faculty over three years.

In this process, which was equipped with a variety of experiences, all MTFs' leadership roles and characteristics, professional visions and identities were observed to be conspicuously (re)formed and (re)constructed through interactions/relationships with people in diverse settings. As per the data set illustrated, the MTFs became more aware of themselves (i.e., weaknesses and strengths, what works or not work and why, what else can be done to reach the goals and address others' needs...etc.) by communicating firstly with their own and secondly others' thoughts/ideas and behaviors. As changing and evolving teacher leaders, the MTFs revised and/or renewed their self-awareness of their professional visions and identities (e.g., values, beliefs, perceptions, knowledge, needs, goals, plans, and potentials) in a self-reflective and self-regulative manner. In this process of professional enhancement, their interactions through discussions especially with the I-LEAD and MSP groups and the feedbacks received from interacting with those group of people inarguably advanced the study participants' level of noticing on the three significant components: PV, PI and TL.

John, for instance, was claiming, "you're not held accountable for your peer" when complaining about his colleagues at his current school. He believed they did not either hear his voice or afforded to understand his practices. That means the negative or lack of interaction affected his leadership identity in a way that he felt worthless and his leadership vision has

changed. He became reluctant to share his creative and innovative ideas with them. He clearly highlighted that challenge(s) he faced directly influenced his self and professional understandings (PI) and design of actions in the profession (PV). He also stopped doing reaching out people in terms of sharing and collaborating in his school. Additionally, he obviously questioned himself and reworked some of his traits, like "I am trying to be less aloof... it's maybe negative trait of mine." [February interview from archival data 2014]

Lessons learned from this challenge might have sparked off him to exhibit his *good pedagogy* to other people out of his school. He asserted, "I want to make myself uncomfortable to make myself do things" in a way without making people feel *insecure or resentful* when making suggestions [January interview 2015]. Then, through positive interactions and giving credit by the MSP group, he comfortably exhibited his leadership skills, and he felt more of a teacher leader outside of the school- like Natalie. He felt more confident as a teacher and department chair in his previous school, not in his current school. However, after being motivated by both the I-LEAD team and MSP group, his perception of his leadership identity and vision changed in a positive direction, as he stated, "I am confident what I am doing" and "I don't worry too much and I think I am able to logically solve problems." [January interview 2015] As Gary stipulated about the way to move forward in their leadership journey: "You don't have the solution given to you unless you have a problem. So the big idea it's a solution to a problem you somehow have to identify." [Summer workshop 2012]

Related to effects of challenging experiences, Natalie was also willing to do some additional activities for teachers out of her school because "[I]t was more difficult for me to be seen as a teacher leader within my school and in my department." [June interview 2015] She thought that there was a distance between her and her colleagues, and she was struggling to get

them to work with her on stuff. And consequently, she became hesitant to share her ideas. She argued, "maybe I wouldn't be as a leader" due to the dynamics in her community, like being negative and critical. The reasons according to her were being the youngest teacher without a formal leadership title, a graduate student, and a Noyce scholar, and her forward personality. Her age and/or her perception of disadvantage of her age discouraged her from taking further actions. However, encouragement by the Noyce group [I-LEAD] and then by the MSP community was helpful for her to be aware of and develop her leadership skills (i.e., asking questions, guiding, dealing with barriers, promoting change...), as she claimed, "I like to create things, come up with new ideas and my own activities or take people's activities and make them better." Most importantly, practicing what she learned, specifically from the I-LEAD, in a positive learning community (MSP group) has helped and forced her to think about "how might I approach what I do with different populations." As a result, her beliefs on her leadership capabilities elevated her professional vision. She repeated being a *nucleation point of change* in the context of teacher leadership this time. Further, she stated her advanced PV, "In a larger community, I feel like I have something to offer now and before I didn't realize that I had something to offer", and her extended PV definition. She claimed,

> PV is how you see yourself as a teacher how you see yourself what lofty goals what things you see yourself accomplishing, what things you see as needing to be changed within our system and understanding and developing ways you try to impact that system. [June interview 2015]

In the same interview, Natalie further elaborated that her PV, "was limited and only focused on myself and I my students. Now, I think that I see the role as a teacher leader as being entered within my professional vision." Her leadership activity focus has changed from classroom to

impacting and helping others see themselves differently to be able to be as impactful within their communities as she was trying be.

Ashley also reflected that her biggest challenge was during her mentoring activities. She was struggling to come up with strategies to deal with her mentee, and seeking suggestions from the I-LEAD group. “Developing who I am as an identity as a teacher leader” was an essential goal for her, and her quite challenging mentoring experience impacted her professional identity negatively since she felt that she might have failed. Although her professional vision and identity signaled towards being a teacher leader before her formal position and the I-LEAD project, this negative effect birched her professional identity formation. However, constant practice enhanced her in the professional identity formation process. Ashley did not give up with the particular person; instead, she applied all the suggestions. She claimed that this was a great experience that made her realize different aspects of leadership and gain more effective leadership skills. The high-pressure mentoring practice helped her develop her leadership skills, leadership identity and associatively her professional vision. She obviously showed this interrelated interaction, “My professional vision has morphed into something where it's my job now to grow other people as teachers.” In so much that, she asserted that she was “trying to figure out how add more to my plate and do it all in an effective mentor” during her outreach activities for other teachers. [February interview 2015]

Professional identity development is a process, which is all about practicing knowledge through relationships in a professional level. As John claimed a very critical idea, “You can never stop. There is always something that you can do better there is always a practice.” Further, and very importantly, he claimed, “if you're not focused on sharing with other people it's really easy not to develop.” [January interview 2015] While the participants were working on building

their practices via rapports with other teachers, they had a chance to realize their own and others' strengths, skills, capabilities in turn to develop their own (and indirectly others') professional vision and identity.

As per the data showed, helping others is part of interaction and through this way, the MTFs' professional vision got shaped. For example, Ashley asserted, "I build my professional vision around helping other people" [February interview 2015]. Meanwhile, as helping others, their leadership/professional skills also developed inevitably. Those skills in turn "form the basis of what you do [PV]... it's also formed by your skills [how you do-PI] in this position" as John stated [January interview 2015]. Thus, it was obvious that leadership [skills, characteristics, and roles] reflects leadership identity and vision, and the opposite direction was also valid. Thus, development in one of those notions also assisted in developing one another. In addition, Ashley provided another significant layer of approach to this possible relationship among PI, PV and TL. She claimed,

> You have to know what your vision is before you can even start to take some actions to accomplish that or to move in that direction. So, without knowing my vision and what I think is important to do as a teacher and as a leader, I' m just kind of stuck. There is no plan and how to implement whatever it is I should be doing because I don't really know what it is I should be doing.

Ashley's insight on a possible timeline among these attributes' development was noteworthy. She asserted that her professional vision was her starting point for her leadership identity and skills development. In another perspective, she also asserted that her professional vision got transformed into different level, which was her primary goal. She also touched on that she attained her primary goal that is growing other people as teacher leaders and as better

teachers in the classroom. Notwithstanding, from another angle, Ashley also propounded her insights on interaction among her professional vision, professional identity, and teacher leadership skills and roles over her leadership trajectories during I-LEAD and her own outreach activities. She expounded that how she saw herself as a leader (PI) also influenced what she thought in her educational practices (PV). That means, her professional identity directed her subsequent practices related to what and how to focus on things that she felt passionate about. Then, in the same interview, she obviously asserted how these notions affected one another in a holistic way:

> Professional vision and professional identity really go hand in hand... Leadership is just one aspect of my professional identity... So, my leadership skills are just one facet. But my leadership skills are kind of how I take my professional vision and spread it.

Natalie provided another significant perspective about the possible interaction of these leadership aspects. According to her, her professional identity that shaped by her personality was about what skills she had and where she was in her leadership journey; her professional vision was about how to improve her leadership skills and practices in properly influencing others. She stated,

> They are intimately tied together, so I think that the characteristics of my personality have helped to shape my professional identity. My professional vision helped me to be able to focus on how I want to best impact others, and change the profession. [June interview 2015]

Overview.

Through participation in the I-LEAD and MSP programs, all MTFs developed more confidence in different contexts (as teachers, mentors, department chairs and/or teacher leaders)

at diverse levels. Both John and Natalie enhanced their leadership skills, identity and vision through engaging with challenges at their schools and then positive interactions with other teachers. The attitudes/approaches of their colleagues, which were seen negatively by John and Natalie, affected their leadership identity formation undesirably that also limited the development of their professional visions and skills. Further, they reviewed their leadership skills and roles, and began to think whether they were capable of taking leadership roles. In Ashley's case, she began her leadership development before John and Natalie, but her professional identity formation was interrupted because of her challenging mentoring experience. Nonetheless, her constant practice and contentious approach on it helped her increase her awareness in reconsidering and reforming her skills, PV and PI. The I-LEAD and MSP groups were strongly influential in terms of energizing and encouraging the MTFs that they were able to improve their leadership skills, PV and PI to be effective leaders.

Based on the MTFs' insights, an enhancement in leadership skills also toned their professional vision and identity. Hence, their leadership skill development and their professional vision and identity formation were significantly interconnected. However, although there is a significant relation between all these components, it is being construed that the starting point of evolving teacher leadership is not clear enough, and what triggered it first remains nebulous. Nonetheless, the common point of all the MTFs was that all these components affect one another in a proportional way in their leadership trajectory.

5 DISCUSSION

In this chapter, I discuss teacher leadership trajectory in the light of the impact of professional development opportunities on MTFs, considering their growing leadership roles/skills, professional vision and identity. This section is organized around five categories: overview of the study, discussions of findings with an embedded comparison of previous research, conclusion, implications, and suggestions for future research.

Overview of the Study

The purpose of this study was to examine the MTFs' perceptions of their leadership roles and capabilities and their professional vision and identity as they participated in the I-IMPACT leadership development-training program and facilitated PDs for K-12 teachers. Specifically, this study asked the following questions:

- How do Master Teacher Fellows' (MTFs') perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development opportunities as they evolve from teachers into teacher leaders?
    1. How do MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through their participation in an I-LEAD professional development leadership program?
    2. How do MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change through professional development activities as they develop, facilitate, and complete Teacher-Driven Professional Development for K-12 teachers?
    3. In what ways do MTFs perceive their professional vision, professional identity, and teacher leadership roles affect one another through their own leadership

trajectories?

A purposeful sampling approach was used to select the participants. Participants in this study were three experienced high school science teachers (MTFs: John, Natalie and Ashley) from the I-LEAD leadership training program. Their years of teaching experience ranged from 5 to 11 years. For this study, I focused on specifically on these three MTFs as evolving teacher leaders because they had plans to provide PD activities to other teachers to improve science instruction strategies. During the professional development (PD) activities (both I-LEAD and outreach), they demonstrated strong interest in their own and others' professional growth.

This embedded case study focused on the MTFs' understanding of their leadership trajectory. The data, obtained from a number of sources, included semi-structured interviews, archival data of I-LEAD, and curriculum artifacts of the PD plans of three MTFs to train other teachers in the spring/summer of 2014 (see Table 3 for details). The data was analyzed with the assistance of QSR Nvivo software using multiple coding methods, In Vivo, Thematic Analysis, and Theoretical Coding (Saldaña, 2009) to generate themes.

An analysis of the data revealed that the participants benefitted from the I-LEAD PDs as they provided discussion platforms (online and face-to-face) for the MTFs to share their experiences and gain useful skills to overcome their problems in teaching, mentoring, and other aspects of teacher leadership. During these meetings, the MTFs enhanced their teaching strategies and skills through interactive workshops, which included activities focused on pedagogical and content knowledge. These activities involved each MTF discussing their mentoring experiences and other leadership roles in the light of existing literature and the project team's experiences. Based on the MTFs' capabilities and resources in their professional communities, they were encouraged to create their goals to be carried out under the project

staffs' guidance. The process assisted MTFs' by allowing them to become much more reflective of their practices, share their insights and feedback to other MTFs (through rich and authentic discussion), and helped them develop their professional and leadership skills, vision, and identity through a cultivated capacity of discerning their beliefs, personal and professional characteristics, and capabilities.

In this process, all MTFs not only improved their PCK, but also their perspectives and effective practices in their leadership path over the first three years of the project. In their role as teachers, MTFs, who identified themselves as having strong PCK, expressed a connection between learning deeply about science content and pedagogy and a greater belief in themselves having the capacity and courage to share what they knew and had learned. Initially, Natalie and Ashley connected their evolvement in PCK with their willingness to share some reform-based instructional practices with other teachers. John extended his PCK evolvement by planning for other students.

As the MTFs' competence with their teaching expertise improved, so did, the MTFs' mentoring expertise under the support of the project leaders. John and Ashley struggled with trying the suggested strategies by the I-LEAD group and coming up with strategies to work with their mentees. Natalie, on the other hand, figured out some effective mentoring approaches shortly. This challenging process of developing leadership through mentoring helped them reconsider their professional identity (PI), professional vision (PV) and leadership patterns. For instance, Ashley believed her professional identity, initially, was affected negatively while struggling with guiding her mentee. As time went by, she recognized the gaps and weaknesses in her leadership skills of her leadership (PI), e.g., being patient with her mentee during preconference sessions. She kept seeing herself differently as she continuously improved those

facets of her leadership roles through discussions on their video prompts that showed their interactions with their mentees. She constructively noticed, interpreted, and reformed her leadership events (PV) that were relevant to the provision of effective leadership (i.e., building positive rapport while uncovering her mentee's strengths) in the process of accomplishing her goals. This was not a straightforward process but involved a continued repeating and refining of their leadership beliefs. All MTFs were encouraged to step out of their comfort zone. MTFs were required to experience some other teacher leadership roles (either formal or informal) beyond their limited interactions with only their students and mentees. These further leadership roles helped them assess their leadership talents as well as potential roles that might align with their beliefs, goals, desires, abilities, capabilities, and so forth.

This process was challenging and led to frustration within the MTFs. For example, Natalie complained about being overloaded with too many expectations and having insufficient time. However, shortly after this realization, they learned specific leadership strategies, which addressed various challenges such as time management, overcoming stress, multi-tasking, rapid decision making, and communicating positively with their colleagues. Ashley exhibited some aspects of leadership before I-LEAD, and then she was encouraged by the project staff to take the department chair position at her school. She believed this formal leadership role shaped her leadership characteristics as she developed rapport with teachers and was able to assist in their development in becoming teacher leaders through assigned roles. She felt fortunate for her professional community and school culture, because they were open and willing to accept leadership roles within their department. This was something that John and Natalie were missing, which was a limitation to their leadership abilities and practices. Nevertheless, they both persisted and pursued their roles by presenting some innovative ideas to their departments such

as organizing and delivering workshops for other students and teachers at their schools. Before his outreach activities, John did not consider himself as, or thought that he was encouraged enough to be, an influential colleague for other teachers' career path. In contrast to John, Natalie desired and expressed a goal to be a guide in shaping other teachers to be leaders despite her limitations of not having a title/formal position in addition to a lack of support by others at her school.

All MTFs reached another milestone in providing PD activities for K-12 teachers within their district. Interacting with other adults/colleagues and practicing leadership at different PLC environments boosted all MTFs' leadership performance. This interaction further increased their self-confidence in terms of building positive relationships, addressing others' needs and demands, and guiding others' learning activities. They felt more comfortable in transferring their knowledge and skills to other teachers' professional progress. Their perceptions about teacher leadership (re)formed and enhanced. Accordingly, they all identified more as teacher leaders as they expanded their views of what it meant to be a leader and accepted their responsibilities (either formally defined or informally defined) as peer leaders.

Discussions of Findings

The perceptions of experienced high school science teachers (MTFs- evolving as teacher leaders) on the influences of leadership training program (I-LEAD) and teacher driven professional development (TDPD) opportunities on their leadership characteristics, professional vision, and professional identity are discussed in this section. In this section, the existing literature is cited to support the findings to present and offer plausible insights into the realm of teacher leadership. This section is organized around four categories. The first three categories are crafted in response to three sub-research questions. The fourth and the last category focuses on

the overarching question and proposes a model/conceptual framework to illustrate how professional vision and identity and teacher leadership roles/skills interact with each other over the leadership development process.

Teacher Leadership Trajectory through the I-LEAD.

The first sub-research question aimed to understand the MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity during their participation in the I-LEAD program.

As it is highlighted in the literature, teacher leaders should have substantial teaching experience and the potential to influence and contribute to their colleagues' practices to continuously improve educational practices (e.g., Can, 2009; Katzenmeyer & Moller, 2001; York-Barr & Duke, 2004). Teaching is also considered to be the starting point of improving teachers' professional vision (PV). Teachers' PV is identified as ability of noticing and making sense of teachers' practices in the context of their classroom (Sherin & van Es, 2009). While a teacher leader needs to excel in his/her teaching role, researchers have found that a strong teaching ability alone is not sufficient to make a teacher leader. This distinguishes a teacher leader from an expert teacher. Being a teacher leader entails increased teacher responsibilities beyond the classroom, which refers to moving out of his/her comfort zone (Ryder, 2013). In this context, as a result of I-LEAD, Ashley, John and Natalie, as lead teachers, extended their perspective in terms of reflecting on and implementing their professional knowledge and skills not only in the classroom, but also in other aspects of leadership. Ashley, when compared to John and Natalie, had a broader view in sharing her expertise even before I-LEAD, as she saw higher value in helping others through sharing her ideas when it was necessary.

In an extensive literature review on roles of teacher leaders, Gabriel (2005) clarified that

not all leadership positions should be official and teacher leaders can serve/help in a variety of matters within their schools (e.g., mentor, grade level leader, peer coach, supplies coordinator, etc.). With respect to this, all MTFs experienced mentoring along with its challenges and benefits. The discussions during the workshops and the project teams' guidance helped the MTFs in enhancing their perspectives by being reflective on their mentoring practices through looking at it from different perspectives. All MTFs, with Ashley the most intentional, tried different strategies in approaching their mentees to address and improve their teaching performance. This finding was consistent with the literature. Jason (2002), for instance, suggested that to be able to help mentees to achieve their specific goals mentors must have a range of different strategies at their disposal. All three MTFs increased their understanding of teacher leadership, with regard to the process of mentoring teaching fellows and student teachers in the classroom. They learned that the process takes time. They also learned from others' experiences through interacting with their mentees, the I-LEAD group, and their science departments at their respective schools.

The results of the study indicate that the participants benefitted mainly from the discussion they had on the issues that other teachers faced. The MTFs discussions around those incidents during the I-LEAD meetings were powerful in helping them address their own problems. These results are mostly consistent with the existing literature. Some research studies state that mentors need additional support to deal with the complexity of their mentoring roles (e.g., Little, 1990; Yendol-Hoppey & Dana, 2007). The findings of this study aligns with this literature as MFTs always sought that additional support by engaging in rich dialogue about their experiences with other MTFs and the project staff. The I-LEAD's discussion platforms served as a support mechanism wherein the MTFs shared their struggles and learned from each other's experiences. As a result they developed strategies to overcome their challenges in mentoring.

There are also researched findings underlining unsuccessful reform-based PD efforts in producing reform-minded mentors (e.g., Crawford, 2007). Whereas, this study has revealed opposing evidence as mentoring experiences of the MTFs were perceived as a foundation for emerging teacher leadership development process. The MTFs experiences with challenging and complex leadership process, with support of the reform-based I-LEAD project structure and team members, increased their awareness and reform-minded approach in mentoring. It also improved MTFs leadership skills and encouraged them to undertake other leadership roles.

It was also evident that challenging factors impacted the MTFs' professional identity negatively at first, i.e., initial frustration they experienced in their leadership roles. This frustration adversely affected the MTFs' understanding of their experiences. They had difficulty with understanding: (a) what was valued and expected of them in the context of mentoring, and (b) their ability of seeing and noticing significant features of teacher leadership (PV). Their self-confidence and efficacy also inhibited their abilities in taking further leadership roles. Those frustrations were given attention on I-LEAD's discussion platform. During these times both the MTFs and the I-LEAD project team members offered strategies about how to address and handle those issues. The MTFs learned from these experiences, eventually realizing that collaboration is a powerful strategy in mentoring (teacher leadership), which should be common practice in their school cultures. The MTFs began to see multiple dimensions of mentoring practice, and stressed the advantage of working with other colleagues in their department, who were already in the profession. Natalie, for example, volunteered to get involved in the induction program at her school as little direction and support had been provided to her in the past when she was a novice teacher.

In existing literature, mentoring is described as one of the formal roles of teacher

leadership in terms of supporting one another and helping each other transform their practices (e.g., Ackerman & Mackenzie, 2006; Dozier, 2007; Swanson, 2000). Accordingly, mentoring, as a subset of teacher leadership, is viewed as a worthwhile experience in shaping and nurturing the MTFs' leadership skills as well as their mentees' teaching methodologies. Therefore, mentoring experiences with reinforcement by the I-LEAD project staff sparked the MTFs to take additional leadership roles to test their skills to determine whether they can transfer those skills into a larger community. In previous research, it was argued that there are a limited number of opportunities for teacher leaders to practice their leadership roles in schools and districts (e.g., Livingston, 1992; Smylie & Brownlee-Conyers, 1992). In this study, it was found that teacher leadership roles (formal or informal) and practices were not limited by a lack of opportunities, but by a lack of support from their school and lack of interaction and miscommunication with their colleagues and administrators. This unfavorable school culture was a significant influential factor for the MTFs in undertaking additional roles to increase student achievement, teacher development, and school improvements. Both Natalie and John's school experiences with their colleagues and principals demonstrated how they were discouraged by the dynamics of their school cultures. Ashley, on the other hand, was encouraged whenever she desired to share new ideas or take on a role to help with school administrators' tasks. These experiences suggest that the dynamics embedded in a particular school culture are determinants of whether or not teacher leaders can maximize their potential to contribute to school success if the opportunities were given (Anderson, 2003; Bambrick-Santoyo, 2013).

The research participants' leadership trajectories and definitions were developed through the informal and/or formal leadership roles that they took either before or during the I-LEAD project activities. While Natalie was experiencing informal (not assigned) leadership roles, John

and Ashley experienced both informal (unassigned) and formal leadership roles (assigned, i.e., department chair). The common point between Natalie and Ashley was that they were more willing to take additional/volunteer leadership roles to be influential on other teachers, as compared to John. Initially, John was unwilling to be responsible for his colleagues' progress due to his disappointing communication issues with them in his current school culture, and the requirements of department chair position in his previous school. Through the I-LEAD support team, he began taking more volunteer leadership roles both in his school and beyond his school. Natalie had similar experiences in her school. Adverse incidents discouraged her from exhibiting her leadership skills. Unlike John and Natalie, Ashley had experienced a supportive school culture, which was another leading factor (in addition to encouragement from the I-LEAD team) for her to become a department chair. It is important to note that Ashley's leadership journey started before the I-LEAD project through her volunteer activities aiming to improve teachers' practices at her school.

As a result of the three years of participation in the I-LEAD project, all MTFs reconsidered and improved their theoretical and practical views on teacher leaders' roles and characteristics, professional vision, and identity. This change was well documented both during leadership practices and discussion platforms. The MTFs wanted to change/reform their beliefs, knowledge, and perceptions on their leadership identity; however, it was challenging, as they expressed. They were well aware that change begins with thoughts and perceptions followed by actions. The MTFs described key leadership components, explained what leadership characteristics they had/used, and forecasted the possible consequences based on their leadership practices (Blomberg et al., 2011; Sherin & van, 2009). They restructured their PV—ability to notice significant components of TL in their practices, and reasoning based on their growing

professional knowledge (i.e., TL) that was their ever-evolving PV. Their awareness of their leadership styles, which primarily relied on creating collaborative and respectful learning environments, directed them to improve their plans of leadership actions to effectively use their leadership skills in growing their leadership practices (e.g., doing outreach PDs for others). The significant common points in the MTFs' revised definition of leadership characteristics served as a *connective tissue* between ideas, classrooms, and teachers and administrators. This also resulted in adaption of additional leadership roles and skills by the MTFs, e.g., being risk taker, collective decision maker, patience, eagerness of sharing reform-based ideas through PD activities; making commitments to contribute to others' career path- growing others as teacher leaders in and out of classroom, developing rapport with and between teachers and administrators; and creating a collaborative professional learning atmosphere for comfortably exchanging ideas.

As the data illustrated, both John and Natalie's leadership beliefs, self-efficacy, and confidence were negatively affected from the lack of support originating from their school culture dynamics. This also influenced their professional identity and professional vision through revising their perspectives and abilities of see and improving their representations of their leadership practices. This further improved their abilities in recognizing and acting upon opportunities both inside and outside of their schools (i.e., doing outreach PD activities) as they sought to improve their leadership skills. This finding is consistent with literature stating that administrative support and proper platforms are needed for teachers to grow into teacher leaders as they take on more roles and improve their leadership capacities (Anderson, 2003; Bambrick-Santoyo, 2013). Research claims that teacher leadership development is not only contingent on the dynamics of school culture, but also under the influence of external factors as well (Can,

2009; Muijs & Harris, 2007), e.g., external PD activities such as the I-LEAD. Combined together these positive dynamics encourage teachers leaders to be effective teacher leaders taking on more responsibilities while practicing their skills. The I-LEAD PD activities nurtured PI development. This extended the borders of the MTFs' PV by their considering how to plan further actions to reach their goals, through promoting interpersonal relationships and building a confidence in sense of self. The MTFs first discovered, and then formed their professional identities (PI) that matured over time within a social context by the external support when there was a lack of support in their school culture (e.g., Komives et al., 2005).

In this process, the way of the MTFs' meaning making on others' thoughts, behaviors, and feedback was through interaction with self and others. This influenced their leadership development as their TL definitions reflected their interpretation of the process. Thus, social interaction within the diverse communities (e.g., their schools culture and the I-LEAD) increased their awareness of how to put their leadership knowledge and skills into practice as they made sense of their own and others' behaviors. From this, they developed their concept of larger social structures and also self-concepts (i.e., professional vision and identity) as consistent with the theoretical framework of this study-*Symbolic Interactionism*- and previous research findings (e.g., Burbank & Martins, 2009; Sandstrom et al., 2003).

To be able to accomplish and sustain these positive outcomes in the MTFs' leadership journey, the I-LEAD project's position was influential in creating an effective PLC. Thus, in these PLCs the MTFs focused on improving their PCK, collaborative and collegial interactions, reflective dialogues, goals, leadership skills, professional visions and identities through continuous feedback, reflection, and collaboration (Dufour & Marzano, 2011; Leithwood & Riehl, 2003; Patterson et al., 2008; Thessin & Starr, 2011). The MTFs were encouraged by the

project team to transform those elements into other collaborative commitments (e.g., TDPD activities), and monitored their professional relationships, actions, and growth to help them develop capacities to meet new expectations and uphold their ongoing activities.

Teacher Leadership Trajectory through TDPD.

The second sub-research question's focus was to understand the MTFs' perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity through teacher-driven professional development (TDPD) activities that the MTFs developed, facilitated, and completed for K-12 teachers.

After being involved in a set of PD activities of the I-LEAD program, the MTFs embarked on a new enterprise as PD developers and facilitators (in TDPD activities) aiming to improve other teachers' (K-12) instructional science knowledge. All of the MTFs voluntarily and enthusiastically involved themselves in these outreach [TDPD] activities in the context of the MSP- Math and Science Partnership program[1]. This was reflective of the literature on TDPD. When experienced teachers are encouraged to facilitate PD programs while sharing their knowledge to improve other teachers' pedagogical and content knowledge, the experience allows them to practice their expertise through interaction with colleagues (Bonner, 2006; Loucks-Horsley et al., 2010; Sparks, 2004; Peckover et al., 2006).

Previous research suggests providing opportunities to teacher leaders to practice their leadership skills both in their own school and outside of their school environment allow teacher leaders to test and improve theirs and others' pedagogical and content knowledge, gain experiences, and sharpen their own leadership skills (e.g., Rhodes & Brundrett, 2006). This was

1 The MSP Program is a federal formula grant program that funds collaborative partnerships between science, technology, engineering, and mathematics (STEM) departments at institutions of higher education (IHEs), and high-need school districts.

observed with the MTFs during the outreach professional development activities; that was, the rediscovery process of their leadership trajectory. These activities helped the MTFs rethink and reconstruct two main ideas: (a) pedagogical and content knowledge, professional beliefs and self-image (PI) with respect to challenging and successful experiences with other colleagues; and (b) leadership roles, aims, and practices of teacher leaders (PV). The process was nurtured mainly by the continuous interaction [during and after the workshops] that the MTFs had with the teachers outside their schools rather than the limited interactions within their schools.

The findings address the gap in the literature about the impacts of such PD activities on teacher leaders. In the course of these events, the MTFs felt more of a teacher leader outside of their school. They were encouraged to practice their leadership abilities through positive interactions and collaborative learning platforms. These experiences, in the context of reflective and respectful interactions, enabled them to view and define their leadership performance along with their shortcomings and strengths from others' perspectives. Their perceptions on their leadership skills, professional identity, and professional vision were dramatically changed, from feeling as an *inferior* at their school to a more effective teacher leader. This was particularly true in John and Natalie's perceptions. This paradigm shift in their leadership identities significantly motivated them in utilizing these positive leadership patterns in other leadership roles at their schools. The growing realization of their ability to construct their leadership identity arose from their ability to notice their leadership practices *out of the box*; that reflected their evolving professional vision. Their productive and socially organized way(s) of knowing and improving their leadership practices (PV) were nurtured and matured through experiencing their leadership capabilities in different social/learning groups. They became aware of the importance of not only proper/improper implications of leadership characteristics and talents, but also desired/undesired

approaches of professional learning environments. They were further able to compare their leadership performance in diverse contexts. The MTFs believed the roles they undertook in different settings with different teacher groups gave them a greater sense of their leadership capacity that subsequently strengthened their professional identity and professional vision.

In addition, the MTFs' leadership practices out of their school helped them identify where they currently were in terms of being a teacher leader, where they desired to be, and what they needed to improve to accomplish their pursuit of their personal leadership trajectory. As Ashley emphasized, "[Y]ou never know what you are going to need beforehand... before doing it." The cultivating contexts of the TDPDs (i.e., availability of resources, positive interactions, and willingness to learn from participating teachers) fostered the MTFs' creative side of teaching and leadership, their self-efficacy and self-confidence in driving their own professional development (e.g., Roth et al., 2011). The MTFs played a critical role in identifying and suggesting solutions on instructional difficulties and needs, which were rooted in their daily work (Colbert et al., 2008). The first hand experiences of the MTFs within the MSP activities not only enhanced the MSP programs' goals, and supported professional growth of the participant teachers through collaborative efforts, but also benefited the MTFs in exercising their leadership roles. Further, the TDPDs experiences provided contexts to the MTFs to identify and address shortcomings they faced in particular subject areas (i.e., science) through their self-reflection.

This finding complements the work of Stoll, Bolam, McMahon, Wallace, and Thomas (2006). The authors purported that professional learning communities (PLCs) serve as platforms in which teachers develop mutual trust, networks, and partnerships. The PLCs fulfilled serving this role for the MTFs. The PLCs played a significant role in creating strong collaborative cultures for MTFs (McLaughlin & Talbert, 2001; Thessin & Starr, 2011). The MTFs enhanced

their collaborative approaches through their involvement in the MSP community and experiencing collective responsibility. In those positive environments, collaborative and collegial interactions occurred, and reflective dialogues took place (Mundry & Stiles, 2009). As a result, the MTFs expanded their leadership perspective by emphasizing collaborative and interactive approaches.

The Interwoven Interaction among Professional Identity, Professional Vision, and Leadership Roles/Skills.

The third sub-question focused on the MTFs' perceptions on the interaction among their teacher leadership roles/skills, professional vision, and professional identity through their own leadership trajectories.

The MTFs' process of reconstructing the dynamic aspects of teacher leadership (leadership characteristics, professional vision and identity) to a large extent was nurtured through PD activities embedded in the I-LEAD and the MSP. For example, the I-LEAD project team infused these dynamic aspects of teacher leadership through: (a) tasks (i.e., videotaping for reflective practices on mentoring); (b) discussions across the workshops; (c) feedback and suggestions of innovative and reform-based ideas; and (d) motivation and/or encouragement.

The I-LEAD team provided discussion platforms and examined the MTFs' PV from short excerpts of videos that reflected the MTFs' own teaching and mentoring practices. Their diverse levels of evolving PVs: their ability of observing, noticing, making sense, and improving leadership practices in a socially organized way, influenced by different sets of shared beliefs and values during the discussions, specifically discussions on the video prompts. As suggested by the research, video clips as prompts served as a key approach in assessing the MTFs' PVs (Blomberg et al., 2011; Kersting, 2008; Santagata, 2009; Sherin et al., 2008). Styhre (2010)

claimed that the development of PV relied on professional support (i.e., I-LEAD) concerning its cognitive and social dimensions (Lefstein & Snell, 2011). The MTFs improved their ability of observing and noticing their weaknesses and strengths of mentoring practices through discussions on their video-clips. Here the video-clips recorded the MTFs conversations with their mentees allowing them to be shared and reflected on with the I-LEAD group. The MTFs were given opportunities to evaluate their PVs within particular contexts, e.g., PLCs and school culture, as teachers, mentors, teacher leaders, PD developers and facilitators (Goodwin, 1994). For instance, when the MTFs took roles as facilitators in TDPD activities, they (re)discovered their leadership abilities and (re)structured their professional visions—ways of seeing and growing aspects of teacher leadership practices (e.g., building positive relationships and collective responsibility)—as assessing their leadership capabilities in different professional contexts (Danielson, 2007; Sherin, 2008), which in turn helped them in designing of their leadership actions (i.e., creating outreach activities for others).

In this study, the MTFs' PV was viewed both as an ultimate outcome and a continuous process, as they were evolving their socially-organized way of thinking and developing leadership practices (Lefstein & Snell, 2011) through benefiting from self-reflections, discussions, and feedback in the context of the I-LEAD and the MSP activities. Consistent with the literature, PV embraced "a dynamic interplay of top-down and bottom-up process" (Sherin, 2007). This dynamic process of MTFs' PV development was observed to be under the constant influence of the MTFs' diverse backgrounds, beliefs, and values that reflected their professional identity. The MTFs' self-understanding of who they were and who they desired to become is referred to as personal and professional identities in the literature (Beijaard et al., 2004). Professional identity is described as one's professional self-concept formed by attributes, beliefs,

values, motives contextual factors, and experiences (Clarke et al., 2013; Slay & Smith, 2011). In this study, the MTFs' PIs structure was observed to be formed over time by these factors (Clarke et al., 2013; Slay & Smith, 2011) and the MTFs practicing of leadership roles. Therefore, professional identity development, like PV, was seen as a process. It was evident that the MTFs' both PI and PV development was *not a linear process* as they experienced, simultaneously, both rewards and challenges in their teacher leadership development. In the process of adapting to their new leadership roles (i.e., as mentors, PD facilitators in and out of school, department chairs) while struggling with those challenges, they constantly questioned themselves about who and where they were (PI), and what and how they lead (PV).

The overall picture illustrated that the MTFs' leadership skill development, their professional vision, and professional identity formation were significantly interrelated. This research study extends our views and/addresses the gap about the relationship among these attributes in the existing teacher leadership literature. Carroll and Levy (2010) suggested reconstruction of PI requires focusing on what to do. Criswell and Rushton (2013) claimed that developing a PV increases PI formation. Blomberg et al. (2011) argued the similarities between PV and PI in terms of seeing PV as a broader concept, which includes norms and beliefs. Muijs and Harris (2007) hinted that PV could be depicted as a way of adaptation of specialized abilities into teacher leadership roles and actions. Bybee (2010) contended that PV signifies seeing a larger picture of systematic issues and having long-term perspective. While the findings of this research study echo the literature cited here from PV and PI focus, the study extends the focus by adding another important facet: teacher leadership characteristics and skills in teacher leadership trajectory. There is not enough evidence to claim which aspects of teacher leadership trajectory triggered one another first or which one was more influential on the other aspects. Nonetheless, it

can be claimed that all the aspects efficiently nurture each other during the teacher leadership trajectory. In addition, this study reveals a restructuring of: (a) PI, pointed out by the MTFs, as who I am, where I am, what my strong areas are, and what other areas I need to improve; (b) PV, referred to by the MTFs, as what I can do/lead, where I desire to be, and how I can lead; and (c) leadership skills as the what and how the MTFs need to focus on in their leadership journey to improve their PI and PV.

Teacher Leadership Trajectory.

This section is crafted as a response to the overarching question through a working model/conceptual framework to illustrate the MTFs' teacher leadership trajectory —how their teacher leadership roles and characteristics, professional vision, and professional identity changed through professional development opportunities as they evolved from teachers into teacher leaders.

The combination of emphasis on professional vision and PCK development was intended to encourage the MTFs' emerging image of themselves as capable, reflective and exemplary teacher leaders. This also turned out to be important for the evolution of the MTFs' professional identity and professional vision. This study found that the MTFs' professional identity and professional vision were mainly impacted by the I-LEAD and their own PD activities. It was an imperative outcome for the MTFs, but also could be a strong potential outcome for their mentees, students, colleagues, and even for the I-LEAD project staff. During this process both Brad and Gary, the I-LEAD team leaders, uttered that their professional identity and vision changed as a result of being self-reflective and seeing practitioners' perspectives across the discussions. These findings are congruent with Sandstrom et al.'s (2003) claim that self-reflective thinking (re)forms the entire project group's views on their practices and action plans.

As the MTFs were involved in the TDPD activities their willingness of sharing ideas constantly increased. They challenged one another's ideas in a positive and constructivist learning environment by creating nonhierarchical community. This finding is consistent with Van Dusen et al., (2012) work.

During the TDPD activities, the MTFs reached the point of feeling like a teacher leader that they did not feel at their own schools—especially true of John and Natalie. These outreach activities helped them reconstruct their professional visions and identities through positive interactions. Lastly, all MTFs began to see, think, and perform differently their outreach activities making them realize the benefits of their teacher leadership development. Thus, their significant attributes changed and evolved in diverse ways over their TDPD journey. These findings address a gap in the TDPD literature in terms of focusing on teacher leaders' leadership development.

Gabriel (2005) identified twenty specific roles (e.g., mentor, presenter, and community leader) for teachers who can take on either formal or informal leadership positions. After three years of participation in the PD activities, the MTFs were able take on different leadership roles, both informal and formal in and out of their schools, and in doing so extended their theoretical and practical views on teacher leadership roles and characteristics/skills. Similarly, the MFTs' TL definitions mostly aligned with the definition used in the study, which is provided in chapter 1. The salient points of the MTFs' TL definition included: serving as a *connective tissue* between ideas, classrooms, teachers and administrators; being a resource for others; being a risk taker; promoting collective decision making; having patience; having eagerness of sharing reform-based ideas through PD activities; making a commitment to contribute others' career path (i.e., growing others as teacher leaders in and out of classroom); developing rapports with and

between teachers and among administrators; and creating a collaborative professional learning atmosphere for comfortably exchanging. However, there was lack of data to claim whether the MTFs employed transparent decision-making and implemented decisions in the interest of entire community's/school's vision and mission, or if they focused on transforming their departments. Most importantly, teacher leadership development was identified as a process that is *not linear*, but full of ups and downs. This realization assisted the MTFs in optimizing their leadership potential, PI, and PV. The existing literature, while defining teacher leadership as a process (e.g., York-Barr & Duke, 2004; Youitt, 2007), never mentioned how those challenges could possibly be used to optimize teacher leadership development process.

In the context of professional developments, the MTFs, both as participants of the I-LEAD project and facilitators of the TDPD activities, frequently cited the following influential factors as significant components of their PD journeys: interactions (positive & negative), building rapport (trust & sincerity- Cohron, 2009), challenges, and collaboration within the PD groups and their schools (e.g., Moller, Mickelson, Stearns, Banerjee, & Bottia, 2013). Secondary influential factors on the MTFs PD journeys were: personal characteristics, strengths and weaknesses (e.g., Kogan, 2000), school and PLCs' culture/structure (e.g., Mundry & Stiles, 2009) that includes administrative support, networking (Salvini, 2010), eagerness and commitment (York-Barr & Duke, 2004), and educational background, e.g., associated certifications and graduate studies (Laguerre, 2010),

Overall, all of the aforementioned factors influentially shaped each MTFs teacher leaderships trajectory in various ways. These factors were rooted in essential leadership components (PI, PV and TL skills and characteristics). During the development process, each of these essential components triggered one another in evolving teacher leadership. PI was

important in helping the MTFs to notice and reconstruct their beliefs, values, personal and professional characteristics, skills, weaknesses and strengths, backgrounds, and capabilities. PV helped the MTFs comprehend their abilities of seeing: what roles and skills were available to them, needed, or demanded from them; how to employ PI; and how to plan and deliver further actions to reach their targets and to be influential on others' areas of professional milieu. The MTFs defined teacher leadership characteristics as auxiliary skills, but as an indispensable factor that helped them blend their PI and PV, and put them in practice.

Furthermore, the MTFs' self-awareness on their leadership characteristics and skills, PI, and PV along with their self-confidence and self-efficacy benefitted their leadership roles, i.e., designing and delivering of the TDPD activities. Lastly, in this evolving process, the most salient supportive context in stimulating the MTFs' teacher leadership process was the PD activities. Self-reflections, discussions, and feedback, during the PDs, accelerated their leadership growth. In this self-reflexive meaning making process, each MTF's awareness increased, and were guided in a proper way that strengthened and reconstructed the MTFs' leadership skills, PI and PV. As the MTFs enduring awareness increased on those dynamic aspects of teacher leadership development, they became stronger practitioner of their leadership positions in their teacher leadership evolutionary process.

My research on the teacher leadership trajectory led me to the development of a working model (Figure 1) that might be useful to better understand science teacher leadership development.

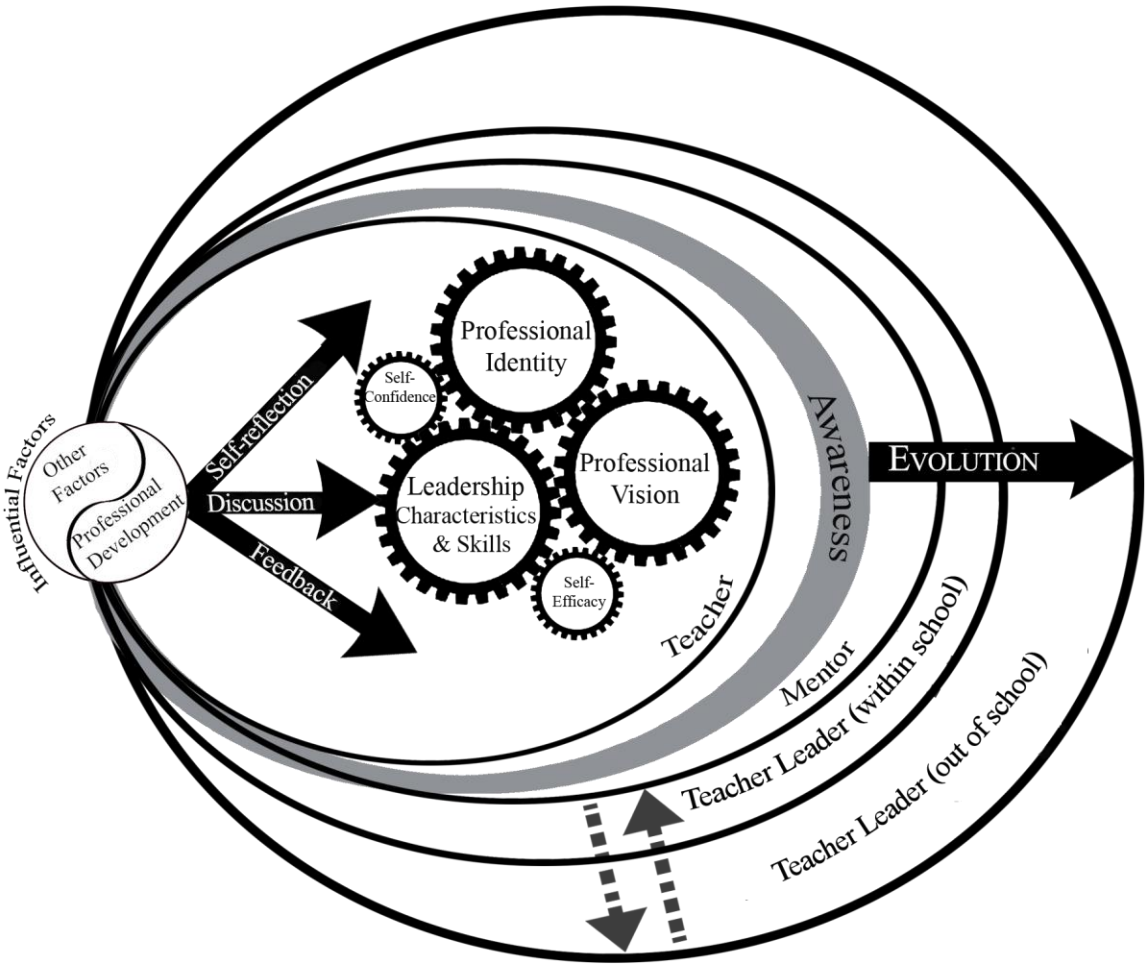

Figure 1. Teacher leadership trajectory

Figure 1 presents a working model that demonstrates a mechanism between the essential leadership components —the interaction among professional vision, and professional identity, and teacher leadership characteristics and skills over the leadership development process. The model represents a mechanism as a feasible framework that is useful in displaying this study's findings on teacher leadership trajectory. The proposed model extends upon previous research and shows the interconnectedness of teacher as self (defined as their self-efficacy, leadership characteristic, identities, vision, and confidence) and teacher defined as leader. Below, I explain the assumptions of the model and its limitations.

The model assumes *reciprocal* relationships, influences, and interactions among professional vision, professional identity, and teacher leadership roles and skills. The model assumes that professional vision, professional identity, and teacher leadership roles and skills are inextricably interrelated. The proposed model makes the following assumptions:

- The essential components of teacher leadership (PI, PV, and TL skills and characteristics) were mainly cultivated by PD opportunities, and associatively by other factors (explained above).
- The teacher leadership journey begins within the context of teaching (as teacher) with support and awareness of the changing/evolving essential components' of teacher leadership (PI, PV, and TL skills and characteristics).
- Teacher leadership is cultivated in different roles, such as mentor and PD developer where teacher leader's awareness of the essential components of teacher leadership increases.
- The strong starting point of teacher leadership development was primarily practicing mentoring, but is not necessarily restricted as the only beginning role for teacher leadership, considering the availability of other possible roles. Teacher leadership development occurs within multiple contexts through multiple roles, and collectively all those roles influence teacher leadership development.
- While positive interactions embedded in teacher leaders' own school culture or in external cultures foster their teacher leadership development, negative interactions hinder and/or strengthen teacher leadership development in terms of seeking other opportunities/roles for growth.

- Elements of the model are extremely interactive and reciprocal and each circle can influence any other or all circles.
- The core of the model consists of essential components' of teacher leadership (PI, PV, and TL skills and characteristics). Those dynamic components are refined, reshaped, and reformed by reflection (including self-reflection and metacognition), discussions, and feedback provided through PD activities and teachers' evolving self-efficacy beliefs and self-confidence.

Teacher leadership mechanism evolves and is strengthened or weakened over time depending on the circumstances in each teacher leadership experience during their professional journey. As stated above, the model assumes *reciprocal* relationships and if those components are weak at any point in time, the circle becomes unstable or smaller for a while. Strengthening the components of the inner circle increases the size of the circle(s) thus changes in TL occurs. To change in a progressive way, profound professional support(s), such as school and external PD support, required.

Conclusion

In this section, several assertions are presented based on the researcher's interpretation of the findings and results. In the general sense, the MTFs' leadership development (i.e., professional identity, vision, and skills) progressed, enhanced, and developed over time while practicing their leadership roles (formal or informal) in their profession and PD activities—both as participants in I-LEAD and facilitators of TDPD. Thus, the first assertion of the study is that professional development activities play a significant role on teachers' leadership development. As it was evident in the I-LEAD project, PD programs should be well designed, have clear and purposeful objectives, provide sufficient and applicable sources, include a collaborative approach

and continued long-term focus, and involve PD developers who have strong experience and research background in delivery and design of PDs. While delivering PDs, the fundamental aspects of teacher leadership should be embedded in PD events. Participating teachers need to be encouraged to strengthen their metacognitive skills as it relates to their leadership practices, and be active participants in discussion platforms, (e.g., professional learning communities) providing feedback to others and be open to learn from others. Therefore, self-consciousness, collaboration, and encouragement are essential details of the PD activities aiming to infuse and enhance those essential leadership qualities (leadership skills, PI, and PV) to teacher leaders.

In addition, the required teacher leadership development tasks (to be done during and after the PDs) should be balanced and consider the participating teachers' capacities, skills, teaching loads, and other commitments they might have in their schools and/or districts, e.g., coaching, curriculum development efforts. Two of the MTFs (John and Natalie) experienced lack of support from their administrators and colleagues prior to their involvement in the I-LEAD program. All research participants had distasteful experiences surfacing from their schools culture, including mentor-mentee interaction. This, in return, lowered their self-efficacy and confidence, negatively affecting their PI. Conversely, the positive experiences, interactions, and constructivist discussions within the I-LEAD group significantly helped the MTFs to reconstruct their PI and PV. All MTFs formed positive sentiments about existing and new challenges and changes; they realized the *nucleus point of change* was self, which turned them into *being agents of change*. Thus, the second assertion of this study is the critical role of the positive collaboration experiences on emerging teacher leaders in overcoming their existing and new struggles as they are evolving into teacher leaders. As Murphy, Manning, and Walberg (2002) claim, collaborative relationships comprise the learning of specific knowledge (i.e., leadership knowledge and skills)

while learning together.

The third assertion is the difference that practice makes in teacher leadership development process. At the heart of the observed teacher leadership growth was the multiple opportunities afforded the MTFs to put what they had learned into practice. Practice expanded the MTFs' leadership knowledge, characteristics, and abilities. It obviously increased their awareness of evolving PI and PV. Through practice, the MTFs had a better understanding of their capacities as teacher leaders and identified the areas of their shortcomings. They worked on addressing their limitations through practice. For example, mentoring practices directly benefited mentors' (MTFs) leadership skills as teacher leaders. Mentoring experience laid the foundation for teacher leadership. The process of mentoring helped mentors to re-evaluate their roles and reflect on them as experienced teachers and teacher leaders. The MTFs practiced designing and delivering teacher driven professional development activities. This greatly benefited them, as they were able to put their leadership skills into practice.

Outreach activities helped the participants to authentically restructure their fundamental leadership constituents (PI, PV, and leadership skills and characteristics). If teachers are provided with opportunities to show their expertise, they would practice and revise their leadership skills both inside and outside of their schools (defined formally or informally). In particular, when teacher leaders are provided with sufficient resources and complemented positively for their roles and expertise, their self-confidence and self-efficacy can strongly advance. Through TDPD activities, the MTFs had opportunities to receive feedback about their practices from other people. During these activities, the MTFs became more aware of their capabilities. They realized that they were the source of knowledge for other teachers and perceived themselves as a nexus between administrators and teachers, between departments, and

even between schools in their school districts. Thus, the MTFs had a better sense of what roles their school or the district demanded from them, and what was valued in a particular professional learning group and school system(s). Thus, they play a crucial role in identifying and suggesting practical and reform-based ideas in closing the gaps in teachers' instructional science knowledge.

The final assertion of this study is the interwoven interaction that exists among professional identity, professional vision, and leadership characteristics and skills. A variety of teacher leadership experiences (i.e., mentoring, developing and delivering PD activities in and out of school, serving as a department chair), PD support, and some factors that PDs include (positive interaction and rapport building, group dynamics and others' attitudes and behaviors, e.g., respect, networking, teamwork, and challenges), and some other factors (personality, commitment, eagerness, graduate school, research/literature) were also found to be influential factors in this study. In brief, the composition of all these factors and primarily the PD opportunities (I-LEAD and TDPD) were noticeably influential in (re)constructing and advancing the study participants' teacher leadership trajectories. All MTFs became more aware of their PI (beliefs, values, personal and professional characteristics, weaknesses and strengths, backgrounds, skills, and capacities), PV (approach on practices and plans of actions), and leadership skills (applying knowledge to needed, demanded, or wanted positions to reach the desirable way of leading). The leadership development process required the interaction among these essential attributes and their restructuring cycle. Each of these attributes triggered one another directly in a proportional way. That is, as PI was reforming, PV and leadership characteristics were also reconstructing each other. As leadership skills (e.g., building relationships, sharing expertise, being a resource, organizing PDs) were improved through practicing leadership roles, PI and PV were energized for transformation and reconsideration. In

other words, changing one's professional vision and/or professional identity allowed him/her to see the context and his practice differently or vice versa. Thus, the person might develop more reasonable leadership actions to promote change of himself or herself and others.

In brief, the MTFs leadership skill development and their professional vision and identity formation were observed as significantly interrelated with each other. Notably, professional development programs, (specifically long term leadership training focus, e.g., I-LEAD, and TDPD), can provide substantial support in evolving these attributes through effectively incorporating self-reflections, discussions, and feedback. Ultimately, the awareness of this inevitable leadership development can motivate teacher leaders to take other leadership roles; that is, more practicing, more experiencing, more realizing, and more restructuring PI and PV as an ongoing trajectory.

Limitations of the Study

Although the researcher conducted this study under the guidance and supervision of experienced researchers in each phase, there were certain limitations to this study. The first limitation was that I was familiar with the topic and study participants due to my past experiences with the I-LEAD program. During this time, I continued to develop trust with participants and used the period of prolonged engagement to build trust and rapport with them. During my involvement in the data collection process from the beginning of the I-LEAD project, I distanced myself from the participants by limiting my interactions with them to minimize researcher bias. Although I immersed myself in the research settings as an onlooker observer, I was cautious to document interpretation of data obtained in the research settings. To accomplish that, I relied on validity and reliability criteria of the study (e.g., peer debriefing, member checking, and analytic memos). In addition, the discussion panels with the project team gave me

additional opportunities to triangulate my interpretations. Engaging in the peer review process reinforced the objectivity of my interpretations.

The second limitation was the small sample size and nature of the teacher participants. Although this study included teacher leaders from various backgrounds and experiences, all teacher leaders were involved in the same teacher leadership professional development program. However, the participants taught at different schools and led science professional development programs at schools other than their own. The number of research participants was limited to three because of the purposeful selection criteria. They were the only ones who were eligible and volunteered to participate. However, conducting this research study with the three participants enriched and deepened the data and analyses, which is recommended for qualitative research (Ritchie, Lewis, and Elam, 2003).

The final limitation of the study was the timeframe and research settings. The study was conducted during the participants' third year in I-LEAD program and continued until the end of their fourth year, when the MTFs completed their own TDPD activities (after summer 2014). Although I believe that I spent extended time with the respondents in I-LEAD program to gain a better understanding of their leadership trajectory, I did not spent enough time in their school culture and everyday working environments due to the research design. Spending time with them in their school culture and other contexts where they exhibited their leadership roles could have helped me to better understand their leadership trajectory. Lastly, I heavily relied on archival data for the three years period that they had spent in the I-LEAD program. I was not able to follow and document the MTFs leadership trajectory from day one to the end of I-LEAD's five years program, so it was a limitation in better understanding their leadership trajectory.

Implications and Recommendations for Future Research

Implications of the study findings for further research and professional development programs are discussed in this section. This research study suggests that teacher leadership development concerning professional identity and professional vision is inextricably linked to professional development opportunities. As a result, there are important implications and recommendations for the teacher education community.

Experienced teachers (MTFs) selected for this study engaged in conversations through PD meetings and interviews concerning their perceptions of their teacher leadership roles and characteristics, professional vision, and professional identity change as they evolved from teachers into teacher leaders. The study participants had an opportunity for self-reflection on their practices at different contexts (as a teacher, mentor, and teacher leader in/out of their schools) through the PD sessions and interviews. Additional interviews with evolving teacher leaders, their school principals, colleagues, or PD developers as well as observations when they practiced their leadership skills would benefit the teacher leadership literature.

Additional research studies are needed to gain a better understanding of teachers' leadership trajectory concerning formal or informal practices in terms of fulfilling their roles both inside and outside of their schools. As the idea of restructuring leadership characteristics, professional identity and professional vision may seem overwhelming to evolving teacher leaders, this study revealed a change in any one of these essential components (PI, PV, and leadership skills) has an impact, with each triggering the others in leadership development. Each of these is improved by experiencing variety of leadership roles over time in profession. This study claims that as teacher leaders practice these roles (i.e., mentoring and other possible teacher leadership roles within and outside of the schools), they need support of their

administrators and require further professional development opportunities to assist the leadership development mechanism in an accurate direction. Thus, additional research on these aspects of teacher leadership development is certainly needed.

Support Embedded in School Culture. As mentioned earlier in the findings section, research participants experienced lack of support from their culture, which included support (or lack of support) of school administration and peer support, and cited communication issues with their colleagues. This study suggests that school leaders should provide positive collaborative platforms, and encourage teacher leaders in internal and external collaborative efforts. Thus, these findings have implications for school administrators. Consistent with existing literature, positive team structures and collaboration creates a stage that teacher leaders can practice their possible leadership roles increasing their realization and effectiveness in sharing their expertise (Andrews & Crowther, 2002; Kelley, 2011; Rogers, 2006). This study proposed that teacher leadership development is a dynamic process, requiring strong professional support for teacher leaders, that should not be restricted to only the school setting. School administrators could ease the transition from teacher to teacher leaders position through collegiality, by outlining the potential roles that teacher leaders will need to take on, and by encouraging teacher leaders to be actively involved in school initiatives inside and outside the school.

Support through Professional Development Programs. Helping teacher leaders to understand and improve themselves as teacher leaders (PI) and their leadership practices (PV) is not a straight and smooth process and require professional support by means of conceiving leadership roles. As schools do not provide adequate support for development of leadership skills, additional professional support could certainly benefit teacher leaders. This is expected to contribute to sustainability and the expandability of the notion of professional vision and

professional identity. Teacher leaders gain an ability of observing and noticing their practices by diverse lenses, and internalizing multiple aspects of leadership in particular educational communities (e.g., Styhre, 2010). In the context of mentoring, for instance, mentors require further professional development to improve teaching in the field of science (e.g., Hudson, 2003). Since mentoring, as a formal leadership position, is seen as a vital step in contributing to nurturing teachers' leadership skills such as guiding, encouraging for networking and growing. In addition, as teacher leaders are given opportunities and encouraged to practice various aspects of the leading process, they spontaneously begin the process of evolving teacher leadership (Bambrick-Santoyo, 2013; Carroll & Levy, 2010). This study claims that long-term and well-designed PD activities for teacher's leadership development enhance teacher leaders' awareness of their leadership skills, PV and PI as well as their self-confidence and self-efficacy. Important to note here, to accomplish these desirable outcomes, high quality PD activities should effectively utilize self-reflections, feedback, and discussions.

The participants (MTFs) put into practice their evolving leadership characteristics, especially in an area wherein there is a need and gap in a particular level (i.e., elementary level science teachers' shortcomings in science teaching). As teacher leaders are actively involved in helping their school systems, they developed a better understanding of leadership aspects (e.g., decision-making, sharing reform-based ideas, and practical solutions) and professional vision that refers to sophistication of their abilities in considering a set of varied perspectives on teacher leadership practices, which is consistent with Muijs and Harris' (2007) study. With respect to this, the findings of this study indicate that teacher driven PD activities benefit facilitators (MTFs) and possibly participant teachers. The focus of research has mostly been on formal teacher leadership roles (e.g., department chair or team leader) in schools or on PD in a regular

sense. This study addresses a gap in the literature by investigating consequences during teacher leaders' evolving process. The study further investigated the leadership development process of MTFs as they were contributing others' professional learning through their designed and delivered PD activities. This study enriched the understanding of the role of professional development and teacher-driven professional development in enhancing teacher leaders' evolution of teacher leadership, professional vision, and professional identity while boosting professional practices (e.g., teaching and learning strategies) of K-12 colleagues. In this process, teachers cultivated each other's practices, revised, and reconstructed their professional visions and identities as a framework for improved professional performances. Research aiming to identify how participating teachers of TDPDs view teacher leaders' performance in developing and demonstrating their leadership skills would be beneficial to the literature. Additional research is also needed to examine teacher leaders' effectiveness in delivering instructional practices for K-12 science teachers.

This study is unique in that it developed the fundamental and dynamic structure to analyze teacher leadership trajectory. There has been limited research about the developmental process of and relationship among leadership characteristics and skills, professional vision and identity. The gap in the literature was narrowed by this study. The study suggests a model that illustrates the mechanism of teacher leadership development concerning these fundamental attributes. The leadership trajectory, clearly, revealed that PV, PI, and TL affect one another. The primary mechanism among PI, PV, and TL was the fact that its a dynamic process of self-awareness of primarily itself. This dynamic mechanism also revealed the importance of self-confidence and self-efficacy, but additional research is needed with a specific focus on critical roles of both main attributes (PI, PV, and leadership skills) and subsequently emerged attributes

(self-efficacy/confidence) in teacher leadership trajectory. The field of teacher education needs additional research on testing the suggested model and adopting or developing the most appropriate model that clearly defines analytical aspects of TL (leadership skills, characteristics and roles, PI, and PV) and the timeline of development of PV and PI.

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APPENDICES

Appendix A

Georgia State University
Department of Middle and Secondary Education
Informed Consent

Title: Evolution of teacher leadership: The influence of leadership professional development opportunities on teacher leaders' perceptions of their leadership characteristics, professional vision, and professional identity.

Principal Investigators: Kadir Demir (PI)
Tugce Gul (Student PI)

I. Purpose:

You are invited to participate in a research study. The purpose of this qualitative case study is to examine master teaching fellows' (MTFs') perceptions of their leadership roles and characteristics, their professional vision and identity as they participate in a leadership development training program. You are invited to participate because you: (1) are an experienced high school science teacher from the I-IMPACT leadership training program, (2) engaged in leadership activities in the I-IMPACT project for the longest period of time (almost three years- Cohort-I), and (3) led science professional development through a Math and Science Partnership (MSP) program at a school other than your own during spring and summer 2014, fitting the time frame of this study. A total of at least 3 participants will be recruited for this study. Participation will require an hour of your time after you are done with your MSP professional development activities.

II. Procedures:

If you decide to participate, you will be asked to share artifacts from the Professional Development you led and allow the researcher to record the interview. The interview will last about 50-60 minutes and will be conducted by Tugce Gul in early September 2014, after your delivery of teacher driven professional development activities. The interview will be recorded with a digital audio recorder and the data will be transcribed for analysis by the researcher. This will take place at a convenient location of your choice.

III. Risks:

In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:

Participation in this study may or may not benefit you personally. It is believed that interviews could benefit participants to understand their own growth in their leadership roles and characteristics and their professional vision and identity as teacher leaders. The study may benefit the field of science education as more is learned about the roles of teacher leaders.

V. Voluntary Participation and Withdrawal:

Participation in research is voluntary. You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

VI. Confidentiality:

We will keep your records private to the extent allowed by law. The PI of the project, Dr. Kadir Demir, (404- 413-8410 or kadir@gsu.edu) and student PI, Tugce Gul (404-579-0931 or tgul1@student.gsu.edu) will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly, the GSU Institutional Review

Board, the Office for Human Research Protection (OHRP). We will use a pseudonym rather than your name on study records. The information you provide will be stored on the password and firewall protected computer of the Student PI. Only the Student PI has access to the password. Only the PI and Student PI will have access to the electronic data. Your name and other facts that might point to you will not appear when we present this study or publish its results. The findings will be summarized and reported in group form. You will not be identified personally.

VII. Contact Persons:

Contact Dr. Kadir Demir at 404- 413-8410 or kadir@gsu.edu) or Tugce Gul (404-579-0931 or tgul1@student.gsu.edu) if you have questions, concerns, or complaints about this study. You can also call if you think you have been harmed by the study. Call Susan Vogtner in the Georgia State University Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu if you want to talk to someone who is not part of the study team. You can talk about questions, concerns, offer input, obtain information, or suggestions about the study. You can also call Susan Vogtner if you have questions or concerns about your rights in this study.

VIII. Copy of Consent Form to Subject:

We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research and participate in the interview, please sign below. In addition, check below to allow us to use your artifacts (e.g., syllabus, ppt, activity sheets, etc.), and have your interview audio-recorded.

_____agree to use of artifacts

_____agree to have interview audio-recorded

_____ _____

Participant Date

_____ _____

Principal Investigator or Researcher Obtaining Consent Date

Appendix B

Interview Protocol

This research is based on a semi-structured interview with each participant. Below, I provide the questions for the interview. Since the interview is semi-structured, the questions below may lead to further questions for clarification without changing the line of questioning.

Instructions

Thank you for taking time for me to interview you. The purpose of this interview is to gain an understanding of your perceptions of the role of teacher leadership, especially in the course of TDPD activities. This interview is completely anonymous and confidential. No information will be shared with anyone without your permission. I will give you a copy of the transcript before analyzing it so you may amend any information you feel is inaccurate for any reason. All information will remain with me, the researcher, in a private database not affiliated with your school or district. So, I would like you to feel comfortable with saying what you really think and how you really feel since there is no right or wrong, or desirable or undesirable answer.

Tape Recorder Instructions

If it is okay with you, I will tape-record our conversation. The purpose of this is to get all the details, and at the same time be able to carry on an attentive conversation with you. You may choose not to respond to any question, and to stop the tape recorder or the interview at any time.

Interview Protocol

1. Tell me about any examples of acting as a teacher leader before you began participating in I-LEAD.
    - Were there any leadership opportunities you considered but did not pursue before beginning the program?
2. Can you tell me a bit about your school culture regarding teachers' leadership activities?
3. Why did you decide to participate in the I-LEAD project?
4. What kind of contribution have you noticed in your leadership knowledge and skills as a result of participating in the I-LEAD project?
5. Regarding the PD activities you organized and facilitated for teachers, what were the challenges you faced?
    - How did what you have learned about leadership in I-LEAD help you navigate those challenges?
6. What factors have prevented you from accomplishing some of the other goals you have set for yourself during I-LEAD and/or your own PD?
7. What can you tell me about the changes to your leadership practices compared to practices before TDPD activities?

- What are the benefits of developing TDPDs?

8. What advice do you have for others who are trying to develop TDPD?
9. What is your next plan to accomplish your goals in developing your leadership characteristics in an effective way?

Professional Vision & Professional Identity Questions

1. How did you perceive your identity as a teacher leader before participating to the I-LEAD trainings? What about since you began participating?
    - (If any) What might influence these changes?
2. Describe you understanding of professional vision.
    - How do you think it is related to functioning as a teacher leader?
3. In what ways do you think your interaction with the teachers during your TDPD activities influenced your perceptions of your leadership role and identity?
4. In what ways do you think the TDPD process helped you to reach your ideal plan of actions and ideal leadership identity as teacher leader?
5. How do you think whether how you see yourself (PI) or your practices (PV) differently as a result of your participation in I-LEAD?
    a. How does the way you see yourself and your practice affect your understanding of yourself as a teacher?
6. Looking at things in the other direction, how do you think your leadership characteristics/roles have influenced your identity and vision?
7. After experiencing I-LEAD PDs and TDPDs, what would you now consider the most helpful aspects of this in the development of your professional identity and professional vision?