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Karen A. Tesik

St. John Fisher University, ktesik@socsd.org

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Teaching, Leading, and Learning in the 21st Century Classroom

Abstract

One critical challenge facing our public school system is the urgent need to transform traditional classrooms into 21st century learning environments. To understand what is impacting this transformation in schools, this quantitative case study used survey data to identify the impact of a teacher's level of transformational leadership on student engagement in the 4Cs of the 21st century: communication, collaboration, critical thinking, and creativity. The results build a case for teacher preparatory programs and policymakers to require the teaching of the transformational leadership theory as a core component of teacher preparatory programs. In addition, this research looked at the impact of teachers' perceptions of 21st century professional development on student engagement in the 4Cs. A recommendation is to further research correlating teachers' growth mindset and their transformational leadership rating to see the possible connections to further support teachers' developing as transformational leaders within the classroom. Finally, this research challenges the New York State Department of Education's recent requirement for 100 hours of professional development for new certification holders. While the research agrees with the need for ongoing professional development for all teachers, the findings show that there is no research identifying a specific number of hours as being optimal for learning, and it shows that developing transformational leadership characteristics in teachers results in greater student engagement in the 4Cs.

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By

Karen A. Tesik

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Supervised by

Dr. Robert Siebert

Committee Member

Dr. Damary Bonilla-Rodriguez

Ralph C. Wilson, Jr. School of Education

St. John Fisher College

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Dedication

This work is dedicated to my husband, Michael, my hero and best friend. I am forever grateful for your support and love. You make me believe in myself, my work, and you are the cornerstone of my life. Together we have, and will continue to build, an amazing life for ourselves and our families.

To my son, Kevin, I cannot express with words the pride I feel in your accomplishments and the person you are. Your ability to take risks and go after your dreams inspired me to follow mine and earn this doctorate. Your laughter and love remain the highlight of my day!

To my parents, Margaret and William Archambault, throughout my life you have always supported me in my quest to answer the question, “Who am I?” This accomplishment is yours as much as it is mine. Your encouragement and love throughout my life made me believe that I could attain this level of achievement.

Finally, to Christopher, through this work, I have shown that you can be the first in your family to achieve great things with the love of your family and by working hard. I encourage you to do the same!

Thank you to Dr. Robert Siebert and Dr. Damary Bonilla-Rodriguez for all of your support, patience, and encouragement. This journey ended successfully because of your ongoing dedication and commitment to my research.

Biographical Sketch

Karen Tesik is a dedicated educator with 25 years of experience. After spending over a decade in the classroom, she took on increasing leadership roles in the New York State K-12 schools, including Instructional Technologist, Instructional Coach for Mathematics, and she is currently Principal of South Orangetown Middle School, a nationally recognized model *School-To-Watch*. She has presented at local, state, and national conferences. Her topics have included Systems Mapping, a process used to connect ideas or initiatives at the district, school, or classroom level and school structures to support academic success and social-emotional growth for students.

Mrs. Tesik attended St. Thomas Aquinas College from 1986 to 1990 and graduated with a Bachelor of Sciences degree in Mathematics with a minor in Secondary Education and a concentration in Computer Science in 1990. Karen attended the New York Institute of New York from 1996 to 1998 and graduated with a Master of Sciences degree in 1998 in Instructional Technology. She also attended the State University of New York, New Paltz, and graduated with a Master of Sciences degree in Educational Leadership in 2005. Karen came to St. John Fisher College in the summer of 2015 and began doctoral studies in the Ed.D. Program in Executive Leadership. Mrs. Tesik pursued her research in teaching, leading, and learning in the 21st century classroom under the direction of Dr. Robert Siebert and Dr. Damary Bonilla-Rodriguez and received the Ed.D. degree in 2017.

Abstract

One critical challenge facing our public school system is the urgent need to transform traditional classrooms into 21st century learning environments. To understand what is impacting this transformation in schools, this quantitative case study used survey data to identify the impact of a teacher's level of transformational leadership on student engagement in the 4Cs of the 21st century: communication, collaboration, critical thinking, and creativity. The results build a case for teacher preparatory programs and policymakers to require the teaching of the transformational leadership theory as a core component of teacher preparatory programs.

In addition, this research looked at the impact of teachers' perceptions of 21st century professional development on student engagement in the 4Cs. A recommendation is to further research correlating teachers' growth mindset and their transformational leadership rating to see the possible connections to further support teachers' developing as transformational leaders within the classroom. Finally, this research challenges the New York State Department of Education's recent requirement for 100 hours of professional development for new certification holders. While the research agrees with the need for ongoing professional development for all teachers, the findings show that there is no research identifying a specific number of hours as being optimal for learning, and it shows that developing transformational leadership characteristics in teachers results in greater student engagement in the 4Cs.

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Chapter 1: Introduction

Introduction

When reauthorizing the Elementary and Secondary School Act, President Barack Obama stated that our goal must be to have a “great teacher in every classroom and a great principal in every school” (The White House, 2011, para. 11). If he replaced the word *great* with *transformational*, would the President have been setting an even higher standard for our nation? Does the research suggest that a transformational school principal, leading a faculty; and a transformational teacher, leading students in a classroom, can take a school to even greater heights than the President imagined?

Transformational leadership was defined by Bass and Avolio (1997) as a leadership approach that causes change in individuals and social systems. In its ideal form, transformational leadership creates valuable and positive change in the followers with the end goal of developing those followers into leaders. Core characteristics of a transformational leader include: trustworthiness; the ability to motivate and inspire each subordinate; and the ability to build, lead, and guide a team to success. By changing just one word in the President Obama’s statement, we move our nation from *hoping for* great school principals and teachers to a new standard of *expecting* them to be transformational, motivational, inspirational, trustworthy, concerned about the individual growth of each student, and responsible to train our nation’s future leaders.

Extensive research exists on the application of transformational leadership theory to school principal leadership. Studies by Blasé (1990) and Thurston, Clift, and Schacht

(1993) support transformational leadership as an effective approach for school principals. Furthermore, research reflects that principals of effective and exemplary schools were described as transformational leaders (Kendrick, 1988; Lontos, 1993; Rodgers, 1994; Sagor, 1992). They built capacity in their schools to promote continual growth in their faculty and their students. By developing a strong school culture that is committed to continual improvement, these leaders paved the way for the transformation of their schools from traditional to highly engaging and motivational 21st century learning environments.

Research also shows that transformational principal leadership is responsible for developing effective schools that maintain high faculty and student morale (Sagor, 1992), have increased student achievement (Kendrick, 1988; Lontos, 1993; Sagor, 1992), have lower dropout rates (Lontos, 1993), and have enhanced school climate (Kendrick, 1988). These key indicators are the result of a transformational principal developing a school culture built on strong, trusting relationships among students, teachers, and administrators. This trust is also the result of the school principals demonstrating an ongoing commitment to the professional growth of the faculty by providing professional development that promotes and develops the talents of each teacher. By doing so, transformational principals model for their staff the expectation that each teacher will develop and support the individual needs of each student. Meeting the learning needs of teachers and students is the cornerstone of successfully transforming our schools into 21st century learning environments (National Education Association, 2012).

Reflecting on this research, one can draw the conclusion that all schools should be led by a transformational principal and not just a great principal (The White House,

2011). But has research built the case that all classrooms should be led by transformational teachers?

It is important to understand that school principal leadership is different than teacher leadership. There is an extensive body of literature on transformational leadership and teacher leadership; however, transformational leadership by teachers is an almost unknown topic (Anderson, 2008). The current body of research on transformational teacher leadership suggests that there is a great need for shifting the paradigm and extending the educational community's definition of teacher leadership to include leading from within the classroom (Beachum & Dentith, 2004; Cheng, 1994; Katyal & Evers, 2004; Peterson & Cooke, 1983; Pounder, 2008; Silva, Gimbert, & Nolan, 2000; Treslan, 2006).

Avolio and Bass (2004), who developed the Multifactor Leadership Questionnaire to determine the level at which an individual is a transformational leader, posited that because transformational leadership can be developed in individuals and there is a possible link between a transformational leadership style in the classroom and increased student engagement, and that this link should be explored and developed in order to transform classrooms into 21st century learning environments. This gap in the research, coupled with the limited amount of research on classrooms as organizations and teachers as leaders within those contexts, gives rise to the need for further research that analyzes the impact of teacher leadership styles on students (Snell & Swanson, 2000).

This need for more research is made more acute by the demands and expectations placed on the 21st century teachers who are leading students in 21st century classrooms, teaching common core curriculum, and charged with preparing students to succeed and

flourish in a dynamic and global society. What was considered a good education 50 years ago, is no longer good enough for success in the 21st century (National Education Association, 2012).

Perhaps equally important to a transformational school principal are teachers who lead their 21st century classrooms as transformational leaders. Research shows that teachers who develop strong relationships that are built on trust motivate their students to engage in difficult and challenging work (Stuhlman, Hamre, & Pianta 2002). These attributes are directly connected to the characteristics of a transformational leader. The four characteristics of a transformational leader are intellectual stimulation, individual consideration, inspirational motivation, and individualized influence. Applied to a classroom teacher, then, the ideal result would be a classroom environment that inspires students to be the best they can be and to persevere when faced with challenges based on a trusting relationship with the teacher. Furthermore, the teacher would meet the needs of each student.

Intensifying the need for teachers to be transformational leaders in the classroom are the Common Core Standards. The new standards set high expectations for all students, but gaps in the curriculum and a mandatory implementation at all grade levels have left many teachers struggling with lesson design. Teachers need to support all students in meeting these new standards. Many students, especially students with disabilities, are finding this difficult, and they are becoming frustrated and anxious (New York State School Board Association, 2015). In classrooms where students trust their teacher to support them in reaching these new standards, students are working harder than ever.

To meet the demands of the 21st century classroom, teachers must adjust their classroom pedagogy from the traditional model of delivery of content to being a facilitator of discovery and inquiry-based learning that fosters greater student engagement in content and promotes 21st century skills (Eduviews, 2008). “For centuries, schools have been structured and perceived as places for teaching. The challenge in the 21st century is restructuring schools as learning places . . . for both students and teachers alike” (Eduviews, 2008, p. 10). In order to support this educational transition, teachers must provide ongoing opportunities to engage in professional development focused on 21st century skills and pedagogy (Darling-Hammond & Richardson, 2009).

The main goal of the educational transition is to prepare students for their entry into a global society. While focusing on teaching the core content subjects—math, science, English, social studies, and the arts, teachers must design daily lessons that include greater opportunities for students to practice and develop critical thinking, communication, collaboration, and creativity skills. These skills are referred to as the *4Cs* or the super skills of the 21st century:

Using the “4Cs” to engage students is imperative. As educators prepare students for this new global society, teaching the core content subjects—math, social studies, the arts—must be enhanced by incorporating critical thinking, communication, collaboration, and creativity. We need new tools to support classroom teachers and education support professionals in their profession, even as they implement new strategies in their classrooms. (Partnership for 21st Century Learning [P21], 2015, p. 3)

Research is clearly and powerfully concluding that today's students need to be moving beyond the basics (P21, 2014). In 2014, a number of high-powered individuals representing leading public and private organizations, such as Apple Computer Inc., Microsoft Corporation, U.S. Department of Education, Dell Computer Corporation, America Online, Time Warner Inc., Consortium for School Networking, State Educational Technology Directors Association, the International Society for Technology in Education, and the National Education Association, joined hands in an effort to identify how the gap between the knowledge and skills taught in schools and the knowledge and skills in demand in typical 21st century society could be bridged (P21, 2014).

This massive effort gave rise to the Partnership for 21st Century Learning (P21) (2014). Part of the mission and vision of P21 is to serve as a catalyst for 21st century readiness at the center of U.S. K-12 education by building collaborative partnerships among education, business, community, and government leaders (P21, 2014). The Partnership for 21st Century Framework was developed to define and illustrate the skills, knowledge, expertise, and support systems that students need to succeed in work, life, and citizenship. This work led to development of the shortened name of the *21st Century Framework*. The framework led schools and educational institutions to embrace the 4Cs or *super skills* for the 21st century—creativity, communication, critical thinking, and collaboration—on a national level as the focus of educational reform (P21, n.d.-b.).

A major challenge that teachers face in implementing the P21 century framework is the requirement to shift their lesson design and pedagogy. Moving to a learner-active, student-centered classroom design that integrates the 4Cs into daily lessons is extremely

difficult. Policy makers and administrators would have to provide professional development opportunities necessary for teachers to shift lesson design and pedagogy into this new 21st century framework (P21, 2008).

Extracting from the aforementioned research, it is evident that the ability to motivate, inspire, build trusting relationships, and meet the individual needs of each student are essential traits a teacher must possess to foster student engagement in the 21st century classroom. Although limited research exists on the teacher as a transformational leader, it is clear that Anderson (2004) showed how the connection between the skills of an effective teacher and his or her interconnectedness to that characteristic of a transformational leader.

Given that there is little research that connects teachers' leadership styles to 21st century classroom skills, as well as to teachers' participation in and perceptions of professional development, this research seeks to fill that void and make three vital connections. By connecting these three elements, teacher leadership, student engagement, and professional development., we may begin to understand the impact a teacher's leadership style has on student engagement in 21st century skill development and teachers' participation in and perceptions of professional development.

Problem Statement

Today's schools and school leaders are faced with a daunting challenge—they must transform the traditional classroom into 21st century learning environments (Bellanca, 2010). Of course, this work is anything but simple, as classrooms become laboratories for student engagement in 21st century skills. School principals, even transformational principals, cannot do this work alone. Teachers must be

transformational leaders of their classrooms. They must do the difficult work of adjusting their pedagogy in order to enhance student engagement in the 4Cs and increase rigor while differentiating to support each learner. Policy makers and administrators both need to support teachers in this difficult task by providing ongoing professional development (Darling-Hammond & Richardson, 2009).

There is a gap in the research that precisely investigates the impact a teacher's leadership style has on the level of students' engagement in 21st century learning. There is also a need to understand the connection between a teacher's leadership style and his/her participation in professional development work that is specifically tailored to support 21st century teaching practices. Finally, there is scant research on how these three, very vital teaching/learning elements (teacher leadership style, teacher engagement in professional development, and levels of student engagement in 21st century learning) interact and impact one another, particularly at the middle-school level. This study attempted to find these connections and to fill the void in the research.

Statement of Purpose

The purpose of this study was two-fold. One purpose was to fill a void in the body of research regarding the role of teachers as transformational leaders in classrooms, particularly, middle-school teachers, because this population is scarcely represented in the published research applying the transformational leadership theory to the classroom environment. This research attempted to fill the void and add to the body of research supporting middle-level education. The second purpose of this study was to add to the growing body of research on teaching, leading, and learning in the 21st century.

Specifically, this research was an attempt to begin work on understanding the influence a teacher's leadership style has on:

- levels of student engagement in the 4Cs, or super skills, of the 21st century;
- participation in professional development activities focused on 21st century teaching and learning; and
- perception of the impact professional development has on the teachers' practice in adjusting to 21st century classroom pedagogy.

Significance of the Study

The significance of this research is to provide insight to teacher-preparation programs, policy makers, administrators, and teachers as to how teachers' leadership styles impact student engagement in the 21st century skill development and how professional development programming can support 21st century teachers and their classroom development.

This study assists in building an understanding of the impact teachers' leadership styles, as measured on the self-rated Multifactor Leadership Questionnaire, along with their commitment to professional development focused on 21st century skills, may have on student engagement. This study gathered middle-school teachers' perceptions of student engagement in the 4Cs—the core of the 21st century reform movement—and the teachers' perceptions and commitment to professional development, which supports their work with students. This study was aimed at contributing to the limited body of research on transformational teacher leadership by quantitatively applying the transformational learning theory to teachers and looking for possible relationships between that leadership style, student engagement in the 4Cs, and the professional development of the teacher.

Theoretical Rationale

This research began in order to explain and understand the way three vital teaching and learning elements: teachers' leadership styles; teachers' participation in and perception of professional development; and students' engagement in 21st century skills in a classroom, impact one another.

For each element, there was an underlying theory used:

- Transformational leadership theory was the basis for investigating teachers' leadership styles. Transformational leadership is defined as leadership that involves change, contrasted against leadership that retains the status quo (Burns, 1978; Kouzes & Posner, 1995; Tichy & Devanna, 1986; Yukl, 2002).

Research has shown that transformational leadership by the school principal and student engagement are associated with positive school outcomes (Appleton, Christenson, Kim, & Reschly, 2006; Finn & Rock, 1997).

Assuming this research is true, could there be a similar correlation between a teachers' leadership style, students' engagement in 21st century skills, and teachers' engagement in professional development designed to promote the 21st century classroom? The researcher's goal was to understand these relationships and add to the limited body of literature on this subject.

- Transformational learning theory was the basis for investigating teachers' involvement in and perceptions of professional development.

Transformational learning theory is defined as the learning that induces an all-encompassing change in learners, and it has a significant impact on their thinking, resulting in a paradigm shift that affects the learners' thinking about

their future work (Finn & Rock, 1997). As teachers face the challenge of transforming from a traditional classroom to a 21st century learning environment that is focused on student engagement in collaboration, communication, creativity, and critical thinking, professional development needs to be based on the transformational learning theory (Pohland & Bova, 2000). Transformational learning theory may be able to shift teachers' thinking, challenge their assumptions, and have a far-reaching impact on their pedagogy.

- Constructivist theory was the basis for investigating student engagement. This research drew upon the core principles of the constructivist theory to support the development of the 21st century classroom. This theory posits that problem solving, critical thinking, and collaborative group work are the core components necessary to increase student engagement in the classroom. It emphasizes that learning is not a linear process but, rather, exploratory in nature, and learning needs to be done in experiential contexts. These principles support the development of the four super skills (4Cs) of the 21st century. While the constructivist theory has been around for centuries, very few classrooms engage students in exploratory learning and differentiate assessments based on individual needs. Very little research has sought to understand how teachers' leadership styles might impact their work with students when the teachers focus is on 21st century skills at the middle-level education.

While each theory is identified for a single element, the researcher acknowledges that these theories could have impacted and overlapped during this research. This hope of the researcher is that this study will fill a void in the research, and it will add to the existing body of work supporting middle-level education.

Research Questions

The research questions that directed this research are:

1. Is there a relationship between a teacher's transformational leadership score (high, moderate, or low) and student engagement in the 4Cs?
2. Does the level to which a teacher perceives professional development influence his or her instructional impact on student engagement in the 4Cs?
3. Does the combined impact of a teacher's transformational leadership score and his or her participation rate in professional development impact student engagement in the 4Cs?

Definitions of Terms

For the purposes of this study, the following definitions were used.

21st Century Skills, 4Cs, 4 Super Skills – communication, collaboration, creativity, and critical thinking (P21, n.d.-b.).

Cognitive Engagement – students' involvement in school activities based on factors such as attention to work, investment and persistence in the work (cognitive effort), problem solving, motivation, and reaction to challenge (Klem & Connell, 2004).

Collaboration – the ability of students to work together to solve problems or answer questions and to work effectively and respectfully in teams to accomplish a

common goal and to assume shared responsibility for completing a task (Hixson, Ravitz and Whisman, 2012).

Communication – the ability of students to organize their thoughts, data, and findings and use them effectively through a variety of media, as well as through oral presentations and in writing (Hixson et al., 2012).

Creativity – the ability of students to generate and refine solutions to complex problems or tasks based on synthesis, analysis, and then combining or presenting what they have learned in new and original ways (Hixson et al., 2012).

Critical Thinking – the ability of students to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning (Hixson et al., 2012).

Ongoing Engagement – the ability of students to exert effort into schoolwork, pay attention in class, prepare for class, and believe doing well in school is important (Klem & Connell, 2004).

Professional Development (PD) – a comprehensive, sustained, and intensive approach to improving teachers' and principals' effectiveness in raising student achievement (Slabine, 2011).

Multifactor Leadership Questionnaire (MLQ 6-Short) – an instrument designed to measure an authority figure's range of command or organization on a continuum from laissez-faire to transactional to transformational (Avolio, Bass, Walumbwa, & Zhu, 2004).

Teacher Leadership – traditionally defined as the process in which an educator exerts influence over colleagues in a school (York-Barr & Duke, 2004). However, in this study, teacher leadership refers to an educator as the person who engages a classroom of students as followers.

Transactional Leadership – a superior (teacher) and a subordinate (student) meet for the purpose of exchanging things of value to each (Burns, 1978).

Transformational Leadership – an educator teaches in a manner that elevates both the superior (teacher) and his or her followers (students) to higher levels of performance and achievement (Bass, 1985).

Chapter Summary

“Teachers as leaders promise to create real opportunities for teachers to impact educational change—without necessarily leaving the classroom” (Troen & Boles, 1994). In this era of high-stakes testing and common core curricula, Anderson (2004) posited that schools need transformational teacher leaders to engage in strong advocacy efforts on behalf of their students, programs, and schools. Students need teachers who have the ability to inspire, motivate, set high expectations, and coach students to success (Wormeli, 2014). Teachers need ongoing professional development to support their work in adjusting pedagogy and curriculum to develop 21st century lessons that result in high levels of student engagement and development of the 4Cs for each student.

Almost non-existent in the literature is the application of transformational leadership theory regarding teacher leadership at the middle-school level. Over 25 years ago, Bass and Avolio (1990) posits that transformational leadership can be developed in individuals. Adding to that statement, Norton (2012) recommended that since there is a

possible link between a transformational leadership style in the classroom and increased student engagement, then this link should be explored. This research explored this link and sought to fill the void in the literature regarding the application of transformational theory as it pertains to teacher leadership at the middle-school level.

This research study has five chapters. The first chapter reviewed the research problem, the purpose of the study, the research question, and the potential significance of the study examining. A review of the literature on transformational leadership in education, professional development, and student engagement is presented in Chapter 2. The research design, methodology, and analysis is discussed in Chapter 3, Chapter 4 presents a detailed analysis of the results and findings, and Chapter 5 discusses the findings, implications, and recommendations for future research and practice.

Chapter 2: Review of the Literature

Introduction and Purpose

To better understand the available body of research, the author conducted a literature search using major social science indexes, such as EBSCO, Wilson Web, Google Scholar, ProQuest, and ERIC. The following is a list of key phrases and words were used to search in the mentioned indexes: teacher leadership, teacher leadership in the classroom, transformational teacher leadership, professional development, instructional leadership impact on student engagement, and 21st century skills.

The purpose of the literature review was to provide the writer with a deeper understanding of the existing body of research in the areas of teacher leadership, 21st century teaching, student engagement in the classroom focused on 21st century skills, and professional development and transformational leadership. This review also gave the researcher an opportunity to develop a stronger understanding of the differences in the qualitative, quantitative, and mixed-methods approaches to research and to assist in creating the methodology for this research study.

Teacher Leadership

Depending on the underlying assumptions of the researcher or the lens for the specific research, teacher leadership has been defined in various ways. This literature review focused on the teacher as a leader within a classroom and as a leader within a school, as well as the literature focused on teachers' transformational leadership styles.

Research focused on teacher leadership from within the four walls of the classroom is limited (Crowther, Kaagan, Ferguson, & Hann, 2002; Katyal & Evers, 2004; Katzenmeyer & Moller, 1996). In 1996, Katzenmeyer and Moller developed a theory around teacher leaders as facilitators of student learning. The theory claims that by empowering and supporting teachers in feeling confident about their ability to lead, fosters within them the responsibility for the learning of all students.

Based on this theory, Crowther et al. (2002) conducted an extensive qualitative study. Their research spanned over a 5-year time period and focused on understanding teachers as leaders. The qualitative data was collected via interviews, observations, and focus groups at over 180 school sites. Their work suggests that teacher leadership is a way of acting that uses the power of teaching to not only shape meaning for children, but for all family members, and it enhances the livelihood of the entire community. This opinion supports the teacher leadership theory developed from the research of Katzenmeyer and Moller (1996). While these findings may be used to build support for teacher leadership, it is imperative to note that the main findings and focus were on teacher leadership within schools where the culture embraced and supported teacher leadership. Also, the research did not go into a detailed analysis of the teachers as classroom leaders.

Also of key importance are a number of large-scale quantitative studies conducted by Leithwood and Jantzi (1999, 2000) designed to explore the effects of school principal and teacher leadership on student engagement. Three sets of practices were defined in the research as a way to define successful leadership practices: setting directions, developing people, and redesigning the organization. The first study found that the

effects of principal leadership on student engagement showed a weak correlation, whereas the effects of teacher leadership were not significant at all. In a second study—a replication—produced a similar result.

Katyal and Evers (2004) reflecting on these studies stated, “Given the influence of teachers, in general, on student learning, the findings concerning teachers seemed counter-intuitive” (p. 368). They conducted research in three schools: one international school and two schools within a local system of Hong Kong. Interviews were conducted with 14 teachers, 12 parents, and three student groups of about 10 students each. This study focused on the perceptions of students, teachers, and parents. Their findings suggest that leadership is “clearly very much an aspect of the teacher’s day-to-day professional lives. It exists in the interactions between teachers and their students” (Katyal & Evers, 2004, p. 380). However, they also noted that determining the impact of teacher leadership in isolation is difficult because they could not control for autonomous learning that takes place outside of school. Learning, for example, driven by a parent at home may have impacted a student’s results.

Katyal and Evers (2004) also found that autonomous self-learning was perceived as being more authentic to the lives of students by a majority of participants. School-site learning was motivated primarily as a means to meet criteria for promotion. Within this context, teachers’ success in promoting student engagement depended primarily on how a teacher structured the social relationship of pedagogy in order to make the school-site learning more authentic and connected to real-life applications that motivated students. Katyal and Evers (2004) then postulated that:

If this is how teachers influence student engagement with school then it will be almost entirely missed by the data categories used in the (1999) Leithwood and Jantzi research because they document teacher leadership mostly in terms of teachers influencing other teachers. (Leithwood & Jantzi, 1999, p. 689)

While there is a great deal of research on the school principal as a transformational leader within a school, very little work has been done on the impact of a teacher with a transformational leadership style. One study noted that transformational leadership from the head teacher did not prove itself to have a positive impact on school improvement that some expected it to be (Harris & Chapman, 2004). Harris and Chapman's research design used a multiple-methods approach. It comprised a review of the literature concerning effective leadership in schools facing challenging circumstances and an in-depth case study data collection from 10 schools facing challenging circumstances.

Contrasting these findings, Cheng (1994) and Pounder (2008) suggested not only a link between teacher leadership styles in the classroom and teacher effectiveness, but more specifically, a transformational teacher leadership style and teacher effectiveness. Cheng's (1994) research investigated how teacher leadership style is related to use of power, social climate, and student-affective performance in a sample of 678 elementary classrooms. The 190 schools were located in Hong Kong. His findings noted that leadership style was found to be strongly related to social climate and student-affective performance. The findings support the importance of a balanced leadership style in classrooms.

Pounder's (2008) research focused on university students in Hong Kong. He employed a full-range leadership model that compared transformational, transactional, and laissez-faire leadership styles. His objective was to develop an instrument to measure the ability of a teacher leader to generate extra effort on the part of students, students' perceptions of the teacher leader, and students' satisfaction with the teacher leader. Scores on each of the transformational leadership scales were significantly and positively correlated with the scores on the leadership outcome scales, including scales broken down by the teacher.

Norton (2012) conducted a third study and examined the relationship between teacher leadership style in the classroom in an affluent middle school and students' cognitive engagement in the teacher's classroom. The research gathered data from the student perception of teacher leadership style. The key finding of this study suggests that "students who perceive that their teacher exhibits strong transformational leadership behaviors in the classroom also perceive that they are more capable of doing the work; they are challenged to think deeply, and they are less likely to avoid novel challenges" (Norton, 2012).

Anderson's (2004) research shows similar findings to Norton (2012) regarding the positive impact on students when teachers exhibit transformational leadership. Anderson (2004), after completing a case study that focused on one school from his larger research study in 2002, showed a significant correlation to transformational teacher leadership and school reform. He captured those behaviors and traits in Table 2.1 and connected them to the six key transformational leadership dimensions outlined by Leithwood, Jantzi, and Steinbeck (1999). Anderson's findings suggest that the school best exemplified

transformational teacher leadership and should be used as an exemplar. He then provided a crosswalk between teacher leadership categories and transformational leadership.

Table 2.1

Teacher Leadership Dimension and Teacher Behaviors/Traits

Transformational Leadership Dimensions	Related Teacher Leadership Categories
Identifying and articulating a vision	Outspokenness, enthusiasm, confidence, and being knowledgeable
Fostering acceptance of group goals	Confronting issues, sharing leadership, relationships
Providing an appropriate role model	Modelling valued practices, responsibility, visibility, and risk taking
High performance expectations	Well implemented; impact on students
Providing intellectual stimulation	Mentoring and communication
Providing individual support	Orientation and being supportive

Note. Adapted from “Transformational Teacher Leadership in Rural Schools,” by K.

Anderson, 2004, *The Rural Educator*, 29, p. 15. Copyright 2004 by National Rural Education Association.

21st Century Skills

Twenty-first century skills must be embedded in all classrooms in order for all students to have a chance to succeed in the workforce after graduation (P21, 2008b). In 2013, a study explored the relationships between 21st century skills development in the classroom, student aspiration in schools, and perceived quality of work later in life. The Gallup (2013) research shows that 21st century skills are advanced skills that prepare and equip youth for the challenges and demands of work in the 21st century. For this quantitative study, the Pearson Foundation, Microsoft Partners in Learning, and Gallup

collaborated to measure these skills alongside nationally validated measures of student aspiration across Americans aged 18-35. The key findings were:

- Developing 21st century skills in the last year of school are positively correlated with higher perceived work quality later in life. In fact, those who had high 21st century skill development are twice as likely to have higher work quality compared to those who had low 21st century skill development.
- Across the 21st century skills included: in this study, real-world problem-solving is the significant driver of higher work quality. However, less than two-thirds (63%) of respondents reported developing this skill in the last year of school and that number drops to less than half (39%) for high school graduates.
- In their last year of school, students who often used 21st century skills in the classroom are more likely to have had greater student aspiration and engagement. Student aspiration and engagement are also positively correlated to work quality later in life. (Gallup, 2013, p. 4) Students who were required to work on extended time real-world problems reported a greater work quality.

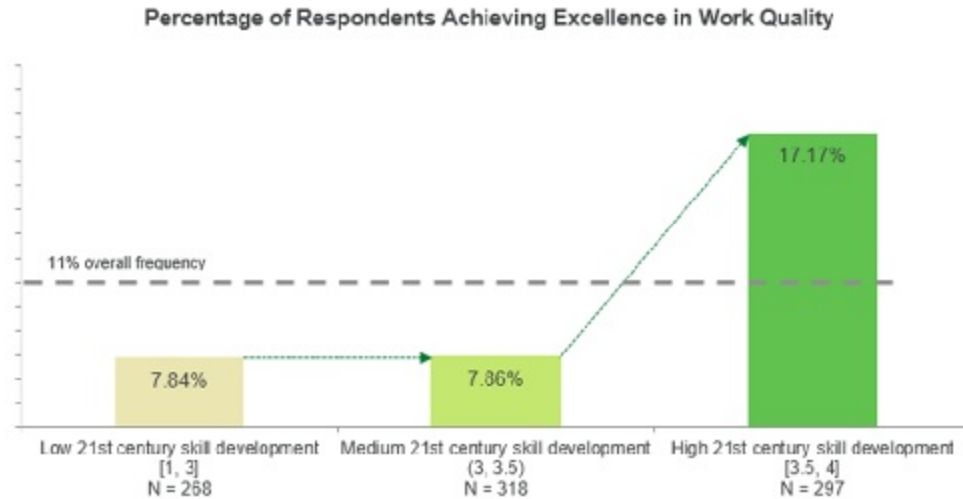


Figure 2.1. Data from research showing the positive impact of high 21st century skill development on achieving work quality. Adapted from “The 21st Century Skills and The Workplace: A Microsoft Partners in Learning and Pearson Foundation Study” by Microsoft, The Pearson Foundation, and Gallup, p. 13. Copyright 2013 by Gallup, Inc.

In agreement with the Gallup poll, Pink’s (2006) book, *A Whole New Mind: Why Right-Brainers Will Rule the Future*, questions the economic future of America if it fails to educate our students with 21st century skills. He stressed that a lack of these skills could result in the need for industry leaders to shift employment to overseas. Pink (2006) asserted that American workers must possess thinking skills and skills that enable them to work effectively with others, including the 21st century skills of the 4Cs. Boutwell (2004) asserted a notion that complemented Pink’s ideas. He posited that as the American economy restructures itself, educators will face a dilemma that warrants major changes in the education field, and he questioned the ways in which educators are preparing students for a world-class workforce. Powerful as they are, these arguments calling for educational reform are really not new since we know that in the mid-19th

century, John Dewey said, “If we teach today’s students as we taught yesterday’s, we rob them of tomorrow” (Dewey, 1944, p. 167).

Research has clearly and powerfully concluded that today’s students need to be moving beyond the basics. In 2014, a number of high-powered individuals representing leading public and private organizations such as: Apple Computer Inc., Microsoft Corporation, U.S. Department of Education, Dell Computer Corporation, America Online, Time Warner Inc., Consortium for School Networking, State Educational Technology Directors Association, the International Society for Technology in Education, and the National Education Association, joined hands in an effort to identify how the gap between the knowledge and skills taught at school and the knowledge and skills in demand in typical 21st century society could be bridged (P21, 2014).

This massive effort gave rise to the Partnership for 21st Century Learning. The mission was to: “Serve as a catalyst to position 21st century readiness at the center of US, K-12 education by building collaborative partnerships among education, business, community, and government leaders” (P21, n.d-a., p. 1). The Partnership for 21st Century Framework was developed to define and illustrate the skills, knowledge, expertise, and support systems that students need to succeed in work, life, and citizenship. This framework led to schools and educational institutions, embracing the 4Cs—super skills for the 21st Century (creativity, communication, critical thinking, and collaboration) on a national level, as the focus of educational reform. (P21, 2015).

Since the framework was developed, numerous researchers have used the 4Cs as a lens in their work. According to the American Management Association (AMA) 2010 Critical Skills Survey, the 4Cs will become even more important to organizations in the

future. Of the four executives who responded to the AMA survey, three (75.7%) said they believed these skills and competencies would become more important to their organizations within the following 3 to 5 years, particularly as the economy improves and organizations look to grow within a global marketplace. Additionally, 80% of the executives who answered the survey believed that fusing the Three Rs (reading, writing, and arithmetic) and the 4Cs would ensure that students are better prepared to enter the workforce (American Management Association [AMA], 2010). Kivunja (2015) and Saxena (2015) agreed in their work that the 4Cs are the super skills for the 21st century, and they will help to develop the qualities that students need to possess in the 21st century for success in college, careers, and citizenship.

Research clearly demonstrates the need for the 4Cs to be embedded into classrooms (American Management, 2010; Saxena, 2015). Even in schools that have focused on embedding the 21st century skill development into their classrooms, measuring the level of student engagement in the 4Cs can be difficult if there is not a clear understanding of the actual tasks students should be engaged in. Supporting this study, the 21st century survey by (Hixson et al., 2012) was used to define each of the 4Cs based on student engagement in the following way:

- Critical thinking skills refer to students being able to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning (Hixson et al., 2012).

- Collaboration skills refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task (Hixson et al., 2012).
- Communication skills refer to students being able to organize their thoughts, data, and findings and share these effectively through a variety of media, as well as orally and in writing (Hixson et al., 2012).
- Creativity and innovation skills refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis, and then combining or presenting what they have learned in new and original ways (Hixson et al., 2012).

In addition to the 4Cs, the survey also sought to gather teachers' perceptions on student engagement in:

- Self-direction skills, which refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback (Hixson et al., 2012).
- Global connections refer to students being able to understand global, geopolitical issues including awareness of geography, culture, language, history, and literature from other countries (Hixson et al., 2012).
- Local connections refer to students being able to apply what they have learned to local contexts and community issues (Hixson et al., 2012).

- Using technology for learning refers to students being able to manage their learning and produce products using appropriate information and communication technologies (Hixson et al., 2012).

The researcher used these data points to see if there was a correlation between teachers' leadership styles and the level of student engagement in the 4Cs. The conceptualization of skills for this instrument came from the 2010 International Innovative Teaching and Learning (ITL) study by Shear, Novais, Means, Gallagher, and Langworthy (2010). The ITL research focuses on teaching practices that have been shown to have strong relationships to 21st century learning outcomes, with a model that draws extensively from leading global research and frameworks including the Partnership for 21st Century. This study of teaching and learning ecosystems was carried out in seven countries: Australia, England, Finland, Indonesia, Mexico, Russia, and Senegal. Key findings from the ITL research include:

- 21st Century teaching supports students' development of the skills that will help them thrive in future life and work.
- Students' opportunities to develop these skills are typically scarce and uneven, both within and across the sample of schools in the study (across all countries).
- While 21st century skill development integration in teaching is becoming more common, use by students in their learning is still an exception in many of schools.
- Teaching practices are more likely to flourish when particularly supportive conditions are in place. These conditions include: Teacher collaboration that

focuses on peer support and the sharing of teaching practices, professional development that involves the active and direct engagement of teachers, particularly in practicing and researching new teaching methods.

- A school culture that offers a common vision of innovation as well as consistent support that encourages new types of teaching. (Shear et al., 2010, p. 12)

These Shear et al. (2010) findings clearly support not only the teaching of 21st century skills, in general terms, but endorses the engagement of students in the 4Cs by suggesting that they are much more likely to build and exhibit 21st century skills if the learning activities in which the students engage as part of a class, and they are asked to demonstrate those skills.

Student Engagement

At the heart of learning is student engagement. Simply put, if students do not engage in the classroom, learning cannot occur. There is research on student engagement that goes back over 70 years. Key researchers and the dates of their publications are found in the timeline in Figure 2.2. Also captured in the timeline is the lens through which the research looked to describe student engagement.

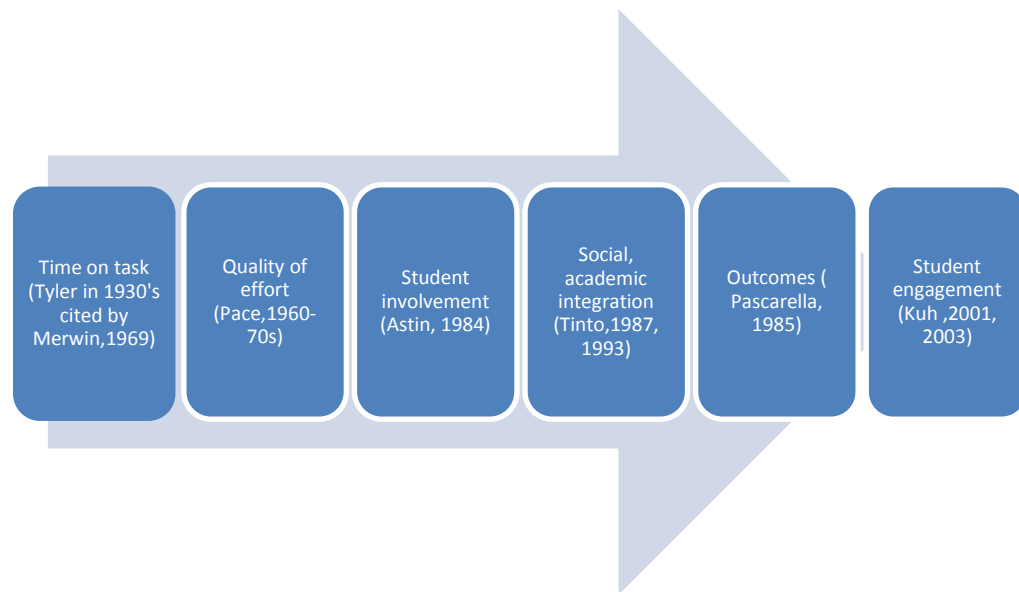


Figure 2.2. Timeline of research on student engagement.

Definitions from a number of studies report that student engagement has been identified as a desirable trait in schools. However, there is little consensus among students and educators as to how to define it (Farmer-Dougan, Farmer-Dougan, & McKinney, n.d.). For the purpose of this study, we define student engagement in the same fashion as we did with the 4Cs, by defining behaviors of students. Skinner and Belmont (1993) stated that students are engaged when they,

show sustained behavioral involvement in learning activities accompanied by a positive emotional tone. They select tasks at the border of their competencies, initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity, and interest. (p. 572)

Reviewing literature focused on student engagement, specifically in the 4Cs, revealed a limited number of studies. However, by expanding the search to 21st century

skills and engagement in middle school, the research offered valuable insight to the researcher.

One key research study focused on bringing the voice of middle school students into the research realm. The purpose of the study was to learn from middle grade students, through surveys and focus groups, what motivates them to become engaged in school. The findings, which centered on student perspectives of the school, uses of technologies in and out of school, and academic engagement, are viewed within the context of global changes and the new demands that this trend places on education.

The participants were 4,000 middle grades students (from sixth, seventh, and eighth grades) who were members in a North Carolina statewide after-school program. Stratified random sampling was used to identify the 4,000 participants (out of the total population of 12,000 after school students) based on geographic region, race, gender, grade level, and family income. The findings of this research under the Engage Us section noted that students want to be engaged and stimulated in school. The findings also suggest that project-based learning (PBL) is the desired form of learning and that students referenced technology as a tool for communication, collaboration, critical thinking, and creativity in their projects (Spires, Lee, Turner, & Johnson, 2008).

However, a research series entitled, *What Do You Do in Schools Today?* (Williams, Friesen, & Milton, 2009), which captured the voices of over 50,000 students in grades 4-12, suggests that traditional assessment practices, not the 4Cs, are driving students to get good grades. The findings suggest that students report that attendance, effort, and homework completion are what they focused on and what attributes to their success (Williams et al., 2009). The researchers noted that this supports what Denise

Clark Pope (2001) called *doing school*. Doing school is described an attitude toward school that develops when students realize that good marks can be earned by compliance with expectations of institutional engagement rather than by meeting expectations for depth, originality, and quality of work (Pope, 2001). Marking practices that favor institutional engagement may reward hard-working students, but they do not necessarily encourage them to explore greater challenges or engage in the 4Cs.

Although these behaviors and dispositions contribute to creating the conditions for learning, they do not tell us what students know and can do as a result of learning. They fail to determine whether or not students are actually engaged in learning. The National Research Council (2003) stated that this focus on compliance also detracts from efforts to “achieve the more ambitious goal of promoting deep cognitive engagement that results in learning” (p. 32). Based on what we now know about how people learn, that past emphasis is being replaced—in research and theory—by a focus on the need for students to reach conceptual understanding within the major disciplines through the “deliberate practice” of 21st century skills (Scardamalia, Bransford, Kozma, & Quellmalz, 2010, p. 20).

The ITL research, referenced earlier in this paper, agrees with the need for students to deliberately practice. It further postulates that students are much more likely to build and exhibit 21st century skills if the learning activities in which they engage are part of a task, which asks them to demonstrate those skills. Figure 2.3 shows the scatter plot of 21st century student scores increasing as the number of learning activities increases. This data shows the importance of continuous engagement in the 4Cs.

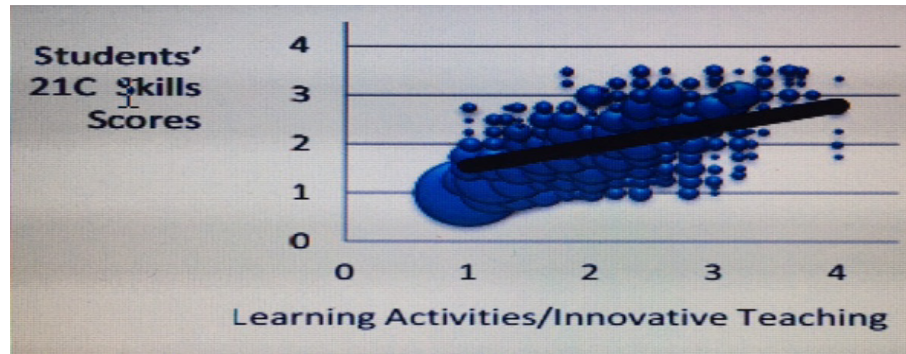


Figure 2.3. Students' 21st century skills scores.

Professional Development

A review of the literature on teachers' professional development gives the impression that PD is the key to successful educational reform (Darling-Hammond & Sykes, 1999; Fullan & Mascal, 2000; Hargreaves, 2000). Research also suggests that investing in teachers and their learning, rather than creating more tests, is a better investment for improving student outcomes (Katzenmeyer & Moller, 1996). Since 2005, an enormous amount of both human and financial capital has been expended on developing federal and state policies around 21st century learning (U.S. Department of Education, 2005). However, if 21st century education is ever going to make a difference in the lives of students, teachers must have the support they need to do this work in classrooms every day (Shear et al., 2010). In addition, teachers must be committed to being lifelong learners focused on improving their craft. Hirsh (2009) stated that:

Professional learning for educators is a crucial step in transforming schools and improving academic achievement. To meet federal requirements and public expectations for school and student performance, the nation needs to bolster teacher skills and knowledge to ensure that every teacher is able to teach

increasingly diverse learners, knowledgeable about student learning, competent in complex core academic content, and skillful at the craft of teaching. (p. 3)

While research suggests that professional development is critical to the success of students, this research was drawn from a limited pool of rigorous quantitative studies (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). In a meta-analysis by Yoon et al. (2007) of 1,300 research studies and evaluation reports, the researchers identified only nine experimental or quasi-experimental studies using control groups with pre- and post-test designs that could evaluate the impact of professional development on student achievement (Yoon et al., 2007). Nonetheless, this meta-analysis suggests that well-designed, professional development can influence teacher practice and have a positive impact on student performance (Yoon et al., 2007).

In addition, professional development should focus on student learning and address the teaching of specific curriculum content (Merek & Methven, 1991). Merek and Methven studied the effects of the learning cycle upon student and classroom teacher performance. In the study, elementary science teachers participated in a 100-hour summer institute during which they engaged in exploring the learning cycle that involved a phenomenon, then they theorized and applied it to new concepts. Applying this new learning to the way lessons were being taught in their classroom the following year, students outperformed the control group on a reasoning test by 44%. Although dated, this study highlights the impact of professional development on reasoning, a skill that is applied in all classrooms and embedded in the 4Cs. It also is referenced in numerous studies because it provides a strong case for supporting long-term professional development compared to attending a 1-day workshop.

Research also implies that while teachers typically need substantial professional development, approximately 50 hours, in a specific area to improve their skills and their students' learning, most professional development opportunities in the US are much shorter. On the 2003-04 Schools and Staffing Survey (SASS) (National Center for Education Statistics [NCES], 2004), a majority of teachers said they had received no more than 16 hours of professional development during the previous 12 months on the content of the subject(s) they taught. Yet, this was the most frequent area in which teachers identified having had professional development opportunities.

Less than one-quarter of teachers reported that they had received at least 33 hours of professional development on the content of the subject(s) they taught (NCES, 2004). The SASS data set is a nationally representative sample of more than 130,000 public and private school teachers across all 50 states and the District of Columbia. The data allowed researchers to evaluate the content of and support for professional development, conditions fostering teacher collaboration and learning, and induction practices nationwide (NCES, 2004). One area missing from the research is how teachers' leadership styles impact the rate at which teachers participate in professional development and the types of professional development (long-term vs. single-day workshops) they participate in (NCES, 2004).

Another key set of data confirming the need for sustained and intensive professional development is contained in a national study of math and science teachers by researchers Garet, Porter, Desimone, Birman, and Yoon (2001) at the American Institute for Research. Their study used a national probability sample of 1,027 mathematics and science teachers to provide the first large-scale empirical comparison of effects of

different characteristics of professional development on teachers' learning. The results from Garet et al. (2001) research identified three core features of professional development that have significant positive effects on teachers' knowledge, skills, and changes in classroom practice: (a) focus on content knowledge, (b) opportunities for active learning, and (c) coherence with other learning activities.

The ITL research (Shear et al., 2010) suggests similar findings by noting that 21st century teaching happens more in environments where teachers have access to strong professional development programs and that when it comes to professional development, both intensity and design, make a difference. The ITL (Shear et al., 2010) research data show that 21st century teaching practices tend to be reported more frequently by teachers whose recent professional development has been longer term and included more hands-on activities, such as practicing teaching methods and conducting research rather than observing demonstrations and listening to lectures. This research also included evidence from teacher interviews that captured how many teachers felt they did not have sufficient access to professional development that offered coherent support for the skills they needed. Commonly cited needs included practical professional development that:

- help teachers learn how to integrate 21st century practices into their teaching,
- go beyond the technical aspects of 21st century teaching to offer explicit guidance on its pedagogical purposes and uses, and
- align with teacher needs (driven bottom-up rather than top-down. (Shear et al., 2010)
- Research shows the importance of professional development to the transformation of classrooms into 21st century learning environments (P21,

2008). School environments that nurture 21st century teaching practices include particular elements such as effectively-designed collaboration and professional development opportunities. These practices appear more likely to evolve when school environments provide coherent support across these elements, offering consistent focus and encouragement toward teacher improvement (Shear et al., 2010).

Chapter Summary

Researchers have posited that leadership, student engagement in the 4Cs, and professional development are critical areas guiding the transformation of classrooms from traditional to 21st century learning environments. Harris and Chapman (2004) posited that:

Coping with the unprecedented rate of change in schools in the 21st century will inevitably require alternative approaches to school improvement and school leadership. If schools are to become learning communities, they cannot operate with models of change and improvement dependent upon individual or singular forms of leadership. Consequently, research is required that explores how teacher leadership can be fostered and developed and how far this form of leadership contributes to building professional learning communities within schools. (p. 8)

After completing this literature review, it is evident that this current study looks to fill a void in the literature noted by many researchers who suggested that there is a lack of work on teacher leadership from within the classroom (Crowther et al., 2002; Katyal & Evers, 2004; Katzenmeyer & Moller, 1996).

This current study looks to add to the growing body of literature supporting schools in successfully transforming traditional classrooms into 21st century learning environments with a goal to support all students in becoming college and career ready. As suggested in Norton's (2012) research, students who perceive that their teacher exhibits strong transformational leadership behaviors in the classroom also perceive that they are more capable of doing the work, are challenged to think deeply, and are less likely to avoid novel challenges. These perceptions are required of students who are going to be engaged in classrooms of the 21st century focused on critical thinking, collaboration, communication, and creativity. This should also help eradicate the misguided perception of students *doing school* (Pope, 2001) to get good grades by simply attending to tasks and, instead, requiring and encouraging students to think deeply and show case their intellectual work.

Further, this study was an effort to support South Orangetown Middle School in its hard work to attain their 21st century goal. This study provided data on the levels of student engagement in the 4Cs and on the work of transforming our classrooms into 21st century learning environments. The power of transformational leadership theory may support this work because, as Katzenmeyer and Moller (1996) stated:

within every school there is a sleeping giant of teacher leadership, which can be a strong catalyst for making change. By using the energy of teacher leaders as agents of school change, the reform of public education will stand a better chance of building momentum. (p. 2)

This research looks to not only wake the giant but to empower the giant to lead by seeking to understand the impact of the transformational leadership theory on teacher

leadership, engagement in 21st century skills, and professional development at the middle level.

Chapter 3 provides information on the design of the study including the participants chosen, instrumentation selected, method of data collection, and the procedures for analyzing the data.

Chapter 3 Research Design and Methodology

Research Design

South Orangetown Middle School has been working on transforming their classrooms to 21st century learning environments for 8 years. Structures to support this work include goal setting, theory of action, and ongoing professional development. These supports have led to a common definition of the 4Cs and a clear understanding of the importance of student engagement. This quantitative explanatory research study sought to understand more precisely how teacher leadership style, student engagement in 21st century skills in the classroom, and teacher engagement in professional development interact and impact one another—particularly at the middle-school level.

The research questions that guided this study are:

1. Is there a relationship between a teacher's transformational leadership score (high, moderate, or low) and student engagement in the 4Cs?
2. Does the level to which a teacher perceives professional development influence his or her instructional impact on student engagement in the 4Cs?
3. Does the combined impact of a teacher's transformational leadership score and his or her participation rate in professional development impact student engagement in the 4Cs?

This chapter provides information on the design of the study including the participants chosen, instrumentation selected, method of data collection and the procedures for analyzing the data.

Description of Methodology

Few researchers have investigated teachers' leadership styles as a means for improving student performance (Cheng, 1994; Pounder, 2008; Yildirim, Acar, Bull, & Sevinc, 2008). Based on this research, numerous articles on teacher leadership and student achievement have been published. However, only a small number of these studies research have been done quantitatively.

Yildirim et al. (2008) tried to quantitatively show a direct association between teachers' leadership characteristics and student performance. This current research study attempted to extend the quantitative work of Yildirim et al. and fill a void in the research focused on transformational leadership applied to teachers the middle-school classrooms.

This current research study applied a quasi-experimental design because the independent variable is a teacher's leadership style. This style is a characteristic of the person. Leadership style is a characteristic of the individual and not directly manipulated by the researcher.

Description of Setting, Population, Participants

The research sought to learn from the population of middle-school teachers in New York State. A purposive sample will be used from South Orangetown Middle School, Blauvelt, New York. This is a nationally-recognized middle school located in a suburb approximately 50 miles north of New York City. The student body consisted of 780 students who were served by 90 teachers and two administrators. The teacher population at the time of the study was 25% male and 75% female, and all teaching staff were invited to participate in the research. Creswell (2008) wrote that a sample size of at least $N = 30$ is needed for a study that compares variables. He also asserted that a larger

sample contributes to “less error variance and better claims of representativeness” (p. 370). A sample size of 65 was appropriate for this study.

The school principal utilized the extended-teacher leadership team to support the creation and assessment of the school goals, theories of action, and to both plan and facilitate professional development opportunities. Approximately 45% of the teaching staff had leadership roles by participating in district-wide curriculum meetings, acting as department or interdisciplinary team leaders, offering professional development to their colleagues, and leading curriculum revision based on the integration of the 4Cs in all subject areas. As an exemplary middle school, the master schedule is designed so that all teachers are part of an interdisciplinary team and department, and time is prepared daily for teachers to plan, collaborate, problem solve, and learn together.

This school developed a goal focused on students developing 21st century skills. The 2014-2015 goal/action plan for the South Orangetown Middle School (Appendix A) states that: “South Orangetown Middle School students will transition to the high school with the knowledge and experience of utilizing 21st century skills and exploring 21st Century Themes” (South Orangetown Central School District [SOCSD], 2014, para. 1). The working theory of action identified on the goal document states:

If we continue to implement “student centered lessons” into our classrooms so that all students engage in our lessons, then all students will acquire the knowledge and skills to succeed as effective citizens, workers, and leaders in the 21st century. (SOCSD, 2014, para. 2)

On the school website, 21st century skills are defined by referencing the Partnership for 21st Century Learning website. The P21 website refers to communication,

creativity, collaboration, and critical thinking as being the “super skills” of the 21st century (P21, n.d.-b., p.1).

Also embedded in their goal document are the professional development supports in place for the staff. This school utilizes both internal and external consultants to provide professional development that supports the goal. The external consultants are staffed from the Intellectual Designs for Education Corporation (IDE). The mission statement of IDE states that: “IDE strives to be the world leader in visioning, designing, and implementing instructional and organizational models that empower all learners. We engage educators in continual reflective practice to shift paradigms and to transform the teaching/learning process” (IDE Corp., n.d., para. 1).

Specifically regarding 21st century skills, the Chief Executive Officer of Intellectual Designs for Education, Dr. Nancy Sulla (n.d.), stated: “Achieving 21st century skills requires changing the *how* of learning: putting students in charge of their own learning with significant structures to enable them to meet with success” (Sulla, n.d., para. 7).

This research looked to support this goal by seeking greater insight into the impact teachers’ leadership styles may have on the implementation of the 4Cs in their classrooms and their commitment to, and perception of, professional development supporting this work.

Data Collection Instruments and Procedures

The three instruments used to gather data were:

Multi-leadership questionnaire (MLQ). This research required participants to complete the MLQ Form 6S (Bass & Avolio, 1997). This instrument was chosen because

it “is successful in adequately capturing the full leadership factor constructs of transformational leadership theory . . . and provides the researcher with confidence, to some certain extent, of an accurate measure of the leadership factors representing transformational, transactional, and non-leadership behaviors” (Muenjohn & Armstrong, 2008, p. 8). Given that this research looked at teaching through the lens of transformational leadership, we calculated one rating for each teacher based on the average of the four areas on the MLQ that was focused on transformational leadership (individual consideration, intellectual stimulation, inspirational motivation, and idealized influence).

Reliability. Pile (1988) tested the instrument using 6-month intervals between assessments and was able to correlate the data between the two assessments. For internal reliability, all but one item on the MLQ demonstrated reliability with alpha coefficients above .70 level, except individual consideration, which was a .68 (Bass & Riggio, 2006; Pounder, 2008). This reliability survey demonstrated excellent reliability, improving on reliable measures from previous studies (std. alpha > .90, inter-item correlations > .58) (Hixson et al., 2012), 2010).

Validity. The MLQ Form 6S was found to measure what it intended to measure. After conducting two studies with large samples, Antonakis (2001) found that the MLQ was valid. In addition, three meta-analyses support the validity of the MLQ; they are DeGroot, Kiker, and Cross (2000); Dum Dum, Lowe, and Avolio (2002); and Lowe, Kroeck, and Sivasubramaniam (1996). Support for the content validity was based on a review of existing frameworks and measures.

21st Century survey. “The conceptualization of skills for this instrument came from the International Innovative Teaching and Learning study (Shear et al., 2010). It also drew upon the deeper learning framework from The William and Flora Hewlett Foundation (2010) and the Partnership for 21st Century Skills website (P21, n.d.-a). For the purpose of the research, we assigned a numerical value (1-4) to each response and calculated the mean for each area based on all of the individual responses for each of the 4Cs.

Professional development reflection form. This instrument was used to collect each participant’s perception on: (a) types of PD (online, in-house, conferences, IDE) the participant attended that was focused on 21st century skill development; (b) the impact PD had on his or her practice (Likert scale) for each PD reported; and (c) the participant’s total number of hours attending PD focused on 21st century teaching during the school year.

With the pre-approval of the superintendent of schools, these data collection instruments were completed during a superintendents’ conference day in the spring of 2017. The researcher in this study is the principal of the middle school. To minimize any risk to the participants, the researcher was not involved in administering the instruments to the volunteers, alleviating any possible pressure for participation or influence from the principal.

Selected by the teacher’s union, an independent data manager (IDM) was responsible to collect all data to ensure anonymity of the participants. The researcher, union representative and the IDM executed agreements clearly identifying the role and responsibilities of the IDM position, as well, a confidentiality agreement was signed.

The IDM collected the participant agreements. For each volunteer, the IDM assigned the faculty member a random 8-digit identification number. These numbers were used on all instruments to allow the data to be collected for each participant and to protect each participant's anonymity. After staff members completed all the instruments, the IDM collected these instruments only from staff who had signed the research participant agreement. The IDM was responsible to review all documents and ensure that no names were on the documents and that the ID number for each participant was labeled on all instruments. The IDM created one data envelope for each participant.

The data envelopes were housed in the independent data collector's classroom in a locked cabinet until all participants had returned all instruments. When all of the participants had submitted the instruments, and the participants' envelopes were complete, the IDM placed the list of participants and identification numbers and certification of confidentiality in a sealed envelope in the middle-school vault. The lock box was labeled "TESIK_RESEARCH" and will be stored for 5 years. All of the data collection envelopes were turned over to the researcher, and the role of the IDM was complete.

Data Analysis

All data was entered into, and analyzed, using the statistical program Statistical Package for Social Sciences (SPSS). The data was stored securely on the researcher's laptop, and when the analysis was complete, all records were transferred to a single flash drive that was password protected and placed in the middle-school vault in a locked box labeled "TESIK_RESEARCH" for 5 years after the publication of this research. After 5

years from date of publication of this research, all documents will be shredded, and the flash drive cleared of all files.

The data was analyzed to examine whether there was a correlation between teacher leadership style (independent variable), teachers' perceptions of professional development, and student engagement in 21st century skills (dependent variables) as measured by the 21st Century Survey. The following hypotheses were developed for each research question and were the basis for testing during the data analysis.

Research question 1. *Is there a relationship between a teacher's transformational leadership score (high, moderate, or low) and student engagement in the 4Cs?*

- H₀(1) There is no relationship between a teacher's transformational leadership score and student engagement in critical thinking.
- H₀(2) There is no relationship between a teacher's transformational leadership score and student engagement in collaboration.
- H₀(3) There is no relationship between a teacher's transformational leadership score and student engagement in creativity
- H₀(4) There is no relationship between a teacher's transformational leadership score and student engagement in communication.

Research question 2. *Does the level to which a teacher perceives professional development influence his or her instructional impact on student engagement in the 4Cs?*

- H₀(5) There is no relationship between the level to which a teacher perceives the impact PD has on his or her instructional impact on student engagement in critical thinking.

- H₀(6) There is no relationship between the level to which a teacher perceives the impact PD has on his/her practice and student engagement in collaboration.
- H₀(7) There is no relationship between the level to which a teacher perceives the impact PD has on their practice and student engagement in creativity.
- H₀(8) There is no relationship between the level to which a teacher perceives the impact PD has on his/her practice and student engagement in communication.

Research question 3. *Does the combined impact of a teacher's transformational leadership score and his or her participation rate in professional development impact student engagement in the 4Cs?*

- H₀ (9) There is no relationship between a teacher's transformational leadership score, combined with the rate of participation in PD, and student engagement in critical thinking.
- H₀ (10) There is no relationship between a teacher's transformational leadership score, combined with participation rate in PD, and student engagement in collaboration.
- H₀ (11) There is no relationship between a teacher's transformational leadership score, combined with their rate of PD, and student engagement in creativity.
- H₀ (12) There is no relationship between a teacher's transformational leadership score, combined with their rate of PD, and student engagement in communication.

To determine the degrees of association between the variables, a bivariate correlation was calculated for each hypothesis. In order to examine whether a statistically significant relationship exists, the data are reported for the variables in each research hypothesis.

The participant responses were large enough to analyze each hypothesis by a two-tailed *t*-test of significance to calculate the Pearson coefficient for each relationship. The following is the scale that was used to determine the extent to which the hypothesis was evaluated based on the Pearson coefficient:

- High correlation: .5 to 1.0 or –0.5 to 1.0.
- Medium correlation: .3 to .5 or –0.3 to .5.
- Low correlation: .1 to .3 or –0.1 to –0.3.

The *t*-test was selected for this study because the *t*-test assesses whether the means of two groups are statistically different from one another. This analysis is appropriate whenever you want to compare the means of two groups (Trochim, 2006)

A one-way analysis of variance (ANOVA) was used to compare the means of each group in correlation to student engagement and professional development. The ANOVA is used to determine whether there are any significant differences among the means of three or more independent (unrelated) groups (Trochim, 2006) The MLQ tested for the three leadership styles and served as a way to develop the groupings.

Conclusion

This methodology was developed by reviewing prior research with quantitative methodology focused on teacher education, leadership styles, and student engagement in 21st century skills (Norton, 2012). The design addressed the ethical concerns noted by the researcher who conducted the research in the school where she is employed. By creating the role of the IDM, in conjunction with the teachers' union and the Superintendent of Schools, the researcher removed the impact she might have had on the outcome of the research. It also allowed the researcher to support the district's work that is focused on student engagement in 21st century skills in the classroom.

Chapter 4: Results

This research study assessed the extent to which transformational leadership, on the part of a teacher, along with the teacher's participation in professional development, impacts student engagement in 21st century skills, which are critical thinking, collaboration, communication, and creativity. This study relied on rating survey data collected from classroom teachers in the middle school of a suburban district. It addressed three primary questions and 12 explicit questions that were introduced and explained in Chapters 1 and 3. The research methodologies, data analysis, and instruments were detailed in Chapter 3. The results and findings of the research methods employed are here presented in Chapter 4.

The next section of this chapter presents a summary of the data collected and discusses variations and changes from the plan discussed in Chapter 3. These changes were due to factors such as the exclusion of some teachers who taught prescribed, scripted programs that did not allow for the inclusion of the 4Cs. Subsequent sections of this chapter address each of the research questions. The final section of this chapter is a short summary of the findings. The final chapter in the dissertation, Chapter 5, discusses the implications and limitations of the findings as well as gives recommendations for additional research on the topic of transformational leadership, student engagement in the 4Cs, and professional development in creating 21st century classrooms.

Surveys Collected

All three instruments, the MLQ Short Form 6x, 21st century survey, and the professional development reflection form, were placed in a collated collection booklet. A total of 64 teachers were present and asked to participate on the agreed upon survey day. It should be noted that the researcher was not on campus the day the survey was completed and the collection process was facilitated by the IDM.

Of the total 64 teachers, 55 teachers consented to participate in the survey. The surveys were reviewed by the researcher and some were returned for invalid responses. The responses were deemed to be invalid when items were left unanswered or when responses appeared to follow a pattern (e.g., all responses on an entire survey were the same number on the Likert scale). These booklets were returned to the IDM who reviewed them with the participants in order to gather valid responses.

At the completion of the data collection process, 51 booklets were available for responses. Four additional books were included in this analysis, but they were missing data points for two of the 4 Cs: creativity and communication. In Tables 4.1, 4.2, 4.3, and 4.4, the crosstabs show the percentages of responses for each of the 4Cs that are broken out by the levels of transformational leadership.

Table 4.1.

Total Transformation vs. Critical Thinking Crosstabulation

Level of Transformational Leadership		Student Engagement in Critical Thinking				Total
		Few Times a Semester	1-3/Month	1-3/Week	Daily	
Moderate	Count	2	8	6	0	16
	% within Total Transformation	12.5%	50.0%	37.5%	00.0%	100.0%
	% within Critical Thinking	66.7%	50.0%	26.1%	00.0%	29.1%
High	Count	1	8	17	13	39
	% within Total Transformation	2.6%	20.5%	43.6%	33.3%	100.0%
	% within Critical Thinking	33.3%	50.0%	73.9%	100.0%	70.9%
Total	Count	3	16	23	13	55
	% within Total Transformation	5.5%	29.1%	41.8%	23.6%	100.0%
	% within Critical Thinking	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.2

Total Transformation vs. Creativity Crosstabulation

Level of Transformational Leadership		Student Engagement in Creativity				Total
		Few Times a Semester	1-3/Month	1-3/Week	Daily	
Moderate	Count	0	6	6	3	15
	% within Total Transformation	00.0%	40.0%	40.0%	20.0%	100.0%
	% within Creativity	00.0%	42.9%	20.7%	42.9%	29.4%
High	Count	1	8	23	4	36
	% within Total Transformation	2.8%	20.2%	63.9%	11.1%	100.0%
	% within Creativity	100.3%	57.1%	79.3%	57.1%	70.6%
Total	Count	1	14	29	7	51
	% within Total Transformation	2.0%	27.5%	56.9%	13.7%	100.0%
	% within Creativity	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.3

Total Transformation vs. Collaboration Crosstabulation

Level of Transformational Leadership		Student Engagement in Collaboration				Total
		Few Times a Semester	1-3/Month	1-3/Week	Daily	
Moderate	Count	2	7	7	0	16
	% within Total Transformation	12.5%	43.8%	43.8%	00.0%	100.0%
	% within Collaboration	100.0%	46.7%	23.3%	00.0%	29.1%
High	Count	1	8	23	4	36
	% within Total Transformation	00.0%	20.5%	59.0%	20.5%	100.0%
	% within Collaboration	00.0%	53.3%	76.7%	100.00%	70.9%
Total	Count	2	15	39	8	55
	% within Total Transformation	3.6%	27.3%	54.5%	14.5%	100.0%
	% within Collaboration	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4.4

Total Transformation vs. Communication Crosstabulation

Level of Transformational Leadership		Student Engagement in Communication				Total
		Few Times a Semester	1-3/Month	1-3/Week	Daily	
Moderate	Count	2	7	4	2	15
	% within Total Transformation	13.3%	46.7%	26.7%	13.3%	100.0%
	% within Communication	33.3%	35.0%	19.0%	50.0%	29.4%
High	Count	4	13	17	2	36
	% within Total Transformation	11.1%	36.1%	47.2%	5.6%	100.0%
	% within Communication	66.7%	65.0%	81.0%	50.0%	70.6%
Total	Count	6	20	21	4	51
	% within Total Transformation	11.8%	39.2%	41.2%	7.8%	100.0%
	% within Communication	100.0%	100.0%	100.0%	100.0%	100.0%

Rationale for Statistical Procedures Used

A critical question that drove this research was whether the level to which a teacher exemplifies characteristics of transformational leadership impacts their work with students on the 4Cs of the 21st century. This question is complex and the means of addressing it are as well. The data was tested for normal distribution. Using the Shapiro-Wilk Test, the data was found to significantly deviate from a normal distribution. Table 4.5 shows the Shapiro-Wilk test results for the collected data set and indicates that all sets fell below the .05 expected value except Moderate/Communication. Based on these results, nonparametric statistical procedures were chosen.

Table 4.5

Shapiro-Wilk Test

4Cs	Total Transformation	Statistic	Shapiro-Wilk	
			<i>Df</i>	Sig.
Critical Thinking	moderate	.798	15	.003
	high	.807	36	.000
Collaboration	moderate	.761	15	.001
	high	.792	36	.000
Creativity	moderate	.806	15	.004
	high	.790	36	.000
Communication	moderate	.882	15	.050
	high	.241	36	.000

Data Analysis and Findings

Selecting the appropriate nonparametric statistical test was important to interpret the data correctly. The Kruskal Wallis test was selected for Research Question 1. The Wilcoxin signed rank test was selected for Research Question 2, and the general linear model to estimate marginal means was used for Research Question 3.

Research question 1. *Is there a relationship between a teacher's transformational leadership score (high, moderate, or low) and student engagement in the 4Cs?*

H₀(1) There is no relationship between a teacher's transformational leadership score and student engagement in critical thinking.

The null hypothesis is rejected. A Kruskal-Wallis H test showed that there was a statistically significant difference in student engagement in critical thinking between the moderate and high levels of transformational teaching, $\chi^2(2) = 10.642, p = 0.001$, with a mean rank student engagement in critical thinking score of 32.26 for teachers with a highly transformational rating and 17.63 for those with a moderately transformational rating.

H₀ (2) There is no relationship between a teacher' transformational leadership score and student engagement in collaboration.

The null hypothesis is rejected. A Kruskal-Wallis H test showed that there was a statistically significant difference in student engagement in collaboration between the moderate and high levels of transformational teaching, $\chi^2(2) = 9.172, p = 0.002$, with a mean rank student engagement in collaboration score of 31.78 for teachers with a High Transformational rating and 18.78 for those with a Moderate Transformational rating.

H₀ (3) There is no relationship between a teacher's transformational leadership score and student engagement in creativity

The null hypothesis is accepted. A Kruskal-Wallis H test showed that there was not a statistically significant difference in student engagement in creativity between the moderate and high levels of transformational teaching, $\chi^2(2) = .121, p = 0.728$, with a

mean rank student engagement in creativity score of 26.42 for teachers with a High Transformational rating and 25.00 for those with a Moderate Transformational rating.

H₀ (4) There is no relationship between a teacher's transformational leadership score and student engagement in communication.

The null hypothesis is accepted. A Kruskal-Wallis H test showed that there was not a statistically significant difference in student engagement in communication between the moderate and high levels of transformational teaching, $\chi^2(2) = .292, p = 0.589$, with a mean rank student engagement in communication score of 26.68 for teachers with a High Transformational rating and 24.37 for those with a Moderate Transformational rating.

Research question 2. *Does the level to which a teacher perceives professional development influence his or her instructional impact on student engagement in the 4Cs?*

H₀ (5) There is no relationship between the level to which a teacher perceives the impact PD has on his or her practice and student engagement in critical thinking.

The null hypothesis is rejected. A Wilcoxon signed-rank test showed that the influence of professional development has a statistically significant impact on student engagement in critical thinking ($Z = -3.833, p = 0.001$). Teachers who perceive that professional development has an influence (somewhat or transformational) on their practice reported a higher level of student engagement in critical thinking with a mean of 4 out of a possible 5 points.

H₀ (6) There is no relationship between the level to which a teacher perceives the impact PD has on his or her practice and student engagement in collaboration.

The null hypothesis is rejected. A Wilcoxon signed-rank test showed that the influence of professional development has a statistically significant impact on student engagement

in collaboration ($Z = -3.893, p = 0.001$). Teachers who perceive that professional development has an influence (somewhat or transformational) on his or her practice report a higher level of student engagement in collaboration with a mean of 3.9 out of a possible 5 points.

H₀ (7) There is no relationship between the level to which a teacher perceives the impact PD has on his or her practice and student engagement in creativity.

The null hypothesis is rejected. A Wilcoxon signed-rank test showed that the influence of professional development has a statistically significant impact on student engagement in creativity ($Z = -3.728, p = 0.001$). Teachers who perceive that professional development has an influence (somewhat or transformational) on their practice report a higher level of student engagement in creativity with a mean of 3.8 out of a possible 5 points.

H₀ (8) There is no relationship between the level to which a teacher perceives the impact PD has on his or her practice and student engagement in communication.

The null hypothesis is accepted. A Wilcoxon signed-rank test showed that the influence of professional development has no statistically significant impact on student engagement in creativity ($Z = -1.745, p = 0.081$).

Research question 3. *Does the combined impact of a teacher's transformational leadership score and his or her participation rate in professional development impact student engagement in the 4Cs?*

H₀ (9) There is no relationship between a teacher's transformational leadership score combined with the rate of participation in PD and student engagement in critical thinking.

The null hypothesis is rejected. There is a significant relationship between the level to which a teacher is transformational, the total hours of PD, and the engagement of students in critical thinking. Furthermore, to describe this relationship and account for small group sizes, the groupings for total hours of PD were reduced from 4 to 2 hours (0-10 hours; more than 10 hours).

Table 4.6 shows the test between the total hours of PD and the total MLQ score for the impact it has on student engagement in critical thinking.

Table 4.6

Tests of Between-Subjects Effects for Critical Thinking

Dependent Variable: Critical Thinking					
Source	Type III Sum of Squares	<i>Df</i>	Mean Square	<i>F</i>	Sig.
Corrected Model	15.238 ^a	7	2.177	4.212	.001
Intercept	445.986	1	445.986	862.987	.000
TotalhoursPD	.577	3	.192	.372	.774
TOTALMLQTL	9.544	1	9.544	18.467	.000
TotalhoursPD* TOTALMLQTL	5.236	3	1.745	3.377	.026
Error	24.289	47	.517		
Total	849.000	55			
Corrected Total	39.527	54			

Note. ^aR Squared = .386 (Adjusted R Squared = .294)

Figure 4.1 shows that number of hours does not have an impact on student engagement, but the level of transformational leadership characteristics does impact student engagement by increasing the mean for the group 1 (0-10 hours of PD) by .8 and the mean of group 2 (more than 10 hours of PD) by .7.

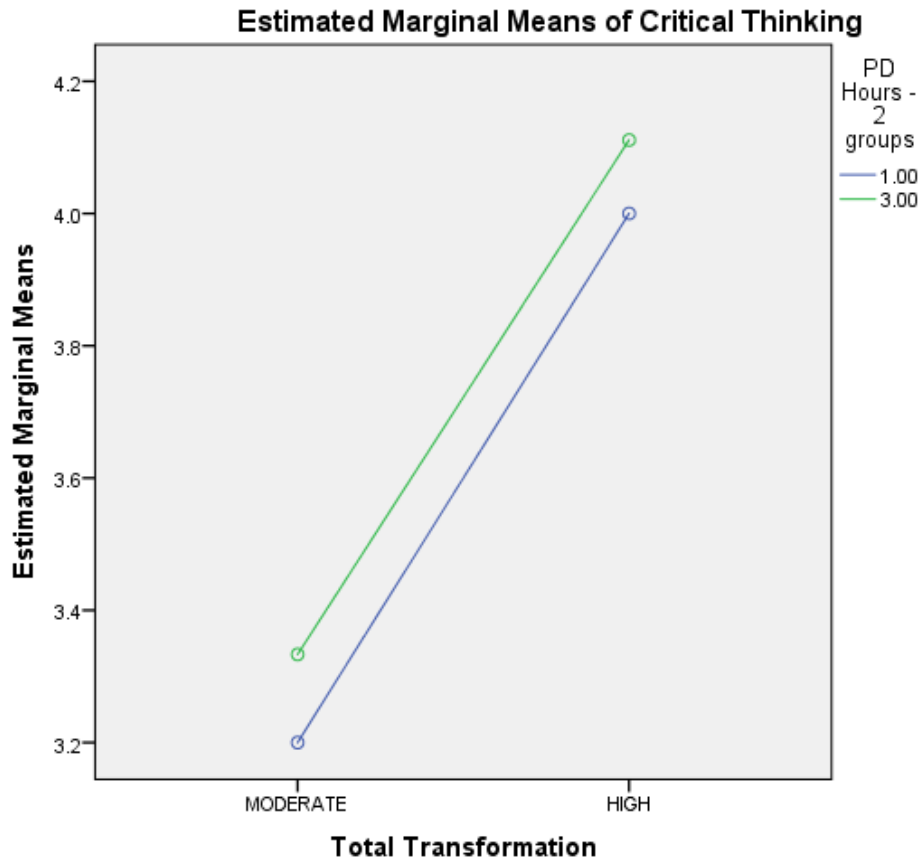


Figure 4.1. Group 1 PD < 10 hours; Group 3 PD > 10 hours

H_0 (10) There is no relationship between a teacher's transformational leadership score combined with participation rate in PD and student engagement in collaboration.

Table 4.7 shows the test between the total hours of PD and the total MLQ score for the impact it has on student engagement in collaboration.

Table 4.7

Tests of Between-Subjects Effects for Collaboration

Dependent Variable: Collaboration					
Source	Type III Sum of Squares	<i>Df</i>	Mean Square	<i>F</i>	Sig.
Corrected Model	9.655 ^a	7	1.39	3.386	.005
Intercept	423.078	1	423.078	1038.622	.000
TotalhoursPD	.808	3	.269	.661	.580
TOTALMLQTL	5.558	1	5.558	13.645	.001
TotalhoursPD* TOTALMLQTL	3.737	3	1.246	3.058	.037
Error	19.145	47	.407		
Total	823.000	55			
Corrected Total	28.800	54			

Note. ^aR Squared = .335 (Adjusted R Squared = .236)

The null hypothesis is rejected. There is a significant relationship ($s < .05$) between the level to which a teacher is transformational and participates in PD and the engagement of students in collaboration. To understand this relationship and to account for a small sample size, the PD groups were recoded into two groups from the original four groups.

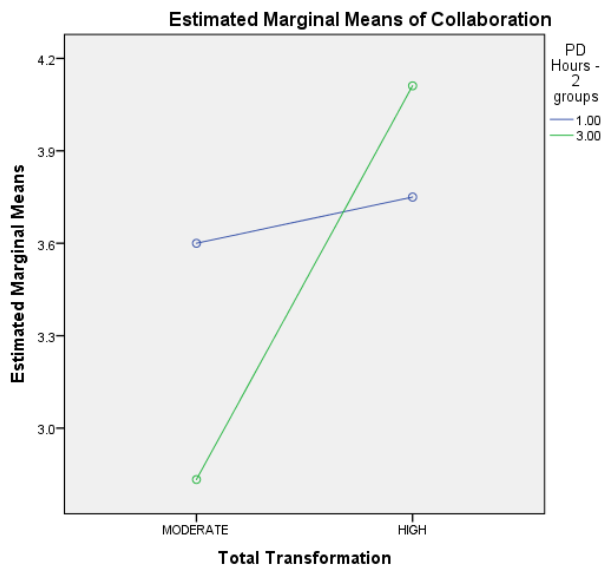


Figure 4.1. Group 1 PD < 10 hours; Group 3 PD > 10 hours.

Figure 4.2 shows that the mean engagement score for collaboration shows a mean increase in teachers participating in more than 10 hours of professional development from the moderately transformational teachers scoring 2.8, to the highly transformational teachers scoring 4.1.

H_0 (11) There is no relationship between a teacher's transformational leadership score combined with his or her rate of PD and student engagement in creativity.

Table 4.8 shows the test between the total hours of PD and the total MLQ score for the impact it has on student engagement in creativity.

Table 4.8

Test of Between-Subjects Effects for Creativity

Dependent Variable: Creativity					
Source	Type III Sum of Squares	<i>Df</i>	Mean Square	<i>F</i>	Sig.
Corrected Model	2.933 ^a	7	.419	.880	.005
Intercept	493.377	1	493.377	1035.954	.000
TotalhoursPD	1.923	3	.641	1.346	.272
TOTALMLQTL	.134	1	.134	.281	.599
TotalhoursPD* TOTALMLQTL	.801	3	.267	.561	.644
Error	20.479	43	.467		
Total	769.000	51			
Corrected Total	23.412	50			

Note. ^aR Squared = .125 (Adjusted R Squared = -.027)

The null hypothesis is accepted. There is no significant relationship between the level to which a teacher is transformational and perceives PD and the engagement of students in creativity.

H₀ (12) There is no relationship between a teacher’s transformational leadership score combined with his or her rate of PD and student engagement in communication.

Table 4.9 shows the test between the total hours of PD and the total MLQ score for the impact it has on student engagement in communication.

Table 4.9

Tests of Between-Subjects Effects for Communication

Dependent Variable: Communication						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	
Corrected Model	56.511 ^a	7	8.073	.880	.979	
Intercept	490.202	1	490.202	1035.954	.001	
TotalhoursPD	13.062	3	4.354	.118	.949	
TOTALMLQTL	1.323	1	1.323	.036	.851	
TotalhoursPD* TOTALMLQTL	6.771	3	2.257	.061	.980	
Error	1588.666	43	36.946			
Total	2560.000	51				
Corrected Total	1645.176	50				

Note. ^aR Squared = .034 (Adjusted R Squared = -.123)

The null hypothesis is accepted. There is no significant relationship between the level to which a teacher is transformational and perceives PD and the engagement of students in communication.

Summary of Results

This research examined what was impacting student engagement in the 4Cs in the classrooms at a suburban middle school. Specifically, it looked to see how engagement was impacted by the level to which a teacher rated transformational (MLQ 6), perceived PD as influential on his or her practice, and/or the hours he or she participated in

professional development focused on 21st century lesson development. The results were different for each of the 4Cs.

The results show that what significantly impacted student engagement in critical thinking was the level to which a teacher rated transformational leadership and perceived professional development. The number of hours spent in PD focused on 21st century classroom design appeared to have no significant impact on student engagement in critical thinking—unless it was combined with transformational leadership ratings. This has various implications that will be discussed in the next chapter.

With regard to collaboration, similar results were found. Student engagement in collaboration was significantly impacted by a teacher's transformational leadership rating, perception of PD influence on their classroom, and hours spent in PD focused on 21st century classroom design. Different than critical thinking, when time and leadership were combined, the linear model reflects that more hours spent in PD, combined with a higher rating on the transformational leadership scale, resulted in a significant difference in student engagement in collaboration.

Student engagement in creativity was found to be impacted primarily by a teacher's perception of professional development having an impact on their pedagogy. Teachers who perceived PD as having no impact had a mean engagement score of 3.667 out of 5 for student engagement. Teachers who perceived that PD as transformational to their classroom lesson design (effecting change on a daily basis) had a mean student engagement score of 3.824 out of 5 in collaboration. Chapter 5 will discuss the implications of these findings.

The only area not be impacted significantly by any of the independent variables was communication. While this result may appear shocking, the role of the teacher has always been, and remains to be, to communicate effectively with his or her students. Although the survey instrument was clear as to what student engagement looked like in a 21st century classroom, this research did not compare that model to a traditional model of teaching. Additional discussion around this will follow.

This chapter outlined the statistical procedures and captured the results of how a teacher's transformational leadership ratings, perception of professional development, and participation in professional development interact and impact student engagement in the 4Cs of the 21st century.

Chapter 5

Introduction

This research study began by challenging the wording of a statement made by President Barak Obama when reauthorizing the Elementary and Secondary School Act, that “our goal must be to have a great teacher in every classroom and a great principal in every school” (The White House, 2011, para.11). If he had replaced the word *great* with *transformational* would the President have set an even higher standard for our nation? That challenge was inspired by the everyday work of the researcher.

As a school principal faced with the challenge of transforming her school from a traditional school to a model school where student engagement is driving success in 21st century skill development, she began to see teacher leadership as the key to transforming the school’s classrooms. Some teachers were in formal leadership positions, like team leader or department leader, but most were leading informally. By sharing ideas, rewriting lessons, participating in professional development with a focus on increasing student engagement in the 4Cs, teachers were leading the school forward in a truly transformational way. As a result of both participating in and observing this dynamic within her school, the researcher began to question whether or not transformational leadership on the part of the teacher was the silent partner in the positive movement in the school. Why transformational leadership?

As the researcher was studying various forms of leadership in her doctoral program, transformational leadership appeared to be closely aligned with the core values

of good teaching. This thinking was supported by Anderson's (2004) crosswalk, noted in Chapter 2, between Bass's original transformational theory and the characteristics of a transformational teacher leader. Therefore, the researcher developed specific questions to seek out the impact of the potentially silent influence (transformational leadership) on behalf of the teacher and student engagement in critical thinking, collaboration, creativity, and communication. Also, to seek a greater understanding of the impact of the school's ongoing professional development, the researcher gathered data on both the teachers' perceptions of the influence of PD on their pedagogy and teachers' participation (total hours) in 21st century PD. With all the elements aligned, this study came into focus.

While engaging in research dedicated to the application of the transformational leadership theory in K-12 education, an issue emerged for the researcher. In spite of its obvious and well-researched significance in business, there is only a small amount of research applying this thought process to K-12 education. Of more concern was that the limited amount of research available focused primarily on the school principal as the leader. Similarly, there was limited research looking at the impact of a teacher's leadership characteristics on student engagement. Therefore, this research became important to fill a void in the research by examining how these three, very vital teaching/learning variables (teacher leadership style, teacher engagement in professional development, and levels of student engagement in 21st century classroom work) interact and impact one another, particularly at the middle school level.

The purpose of this study was twofold. One purpose was to fill a void in the body of research on the role of the teacher as a transformational leader in a classroom; in

particular, a middle school teacher because this population is scarcely represented in published research. The second purpose was to add to the growing body of research on teaching, leading, and learning in the 21st century. Specifically, this research focused on investigating:

1. Is there a relationship between a teacher's transformational leadership scale (high, moderate, or low) and student engagement in the 4Cs?
2. Does the level to which a teacher perceives PD influences his or her instruction impact student engagement in the 4Cs?
3. Does the combined impact of a teacher's transformational leadership score and his or her participation rate in PD impact student engagement in the 4Cs?

This case study has significance not only for the school studied but for teacher-preparation programs, policy makers, administrators, and teachers by providing insight into how a teacher's leadership style impacts student engagement in 21st century skill development and how professional development programming can support 21st century teacher and classroom development.

Transforming our classrooms from traditional classrooms to 21st century learning environments is arguably the most important change and transition educators must achieve for their students if the students are to be successful in college and career. Understanding what impacts this transition is critical. This research investigated and identified variables impacting student engagement in the 4 Cs, which are the super skills of the 21st century. Engaging students in the 4Cs is critical to their success in college and career. The international innovative teaching and learning research, referenced earlier in this paper, agrees that students are more likely to build and exhibit 21st century skills if

the learning activities in which they engage are part of a class that asks them to demonstrate those skills daily. The findings of this research suggest that teachers who exhibit high levels of the characteristics of transformational leadership, in fact, engage students more often in critical thinking and collaboration, and therefore, they prepare students better for college and career.

In addition, this research, which was based on the constructivist theory, shows how a teacher with a high score on the transformational leadership rating scale employs this theory by actively engaging students in the 4Cs daily and expedites the time to transform a classroom from the tradition classroom model to a 21st century learning environment with high student engagement. This research provides a basis for viewing the teacher as an integral leader in the change process within our schools—not just a leader but a transformational teacher leader—is the key to speeding up the process of moving our schools forward in the work of engaging students. It also answers the original question posed by the researcher. If President Barack Obama had changed the word from great to transformational, he would have set a higher standard for our nation.

While agreeing with prior research that has shown transformational school principal leadership and student engagement are associated with positive school outcomes (Appleton et al., 2006; Finn & Rock, 1997), this research shifts the lens of leadership off the principal and onto the classroom teacher and begins to fill a void in the research. A study by Snell and Swanson (2000) found that there is a limited amount of research on teachers as leaders within the classroom. This research fills this void by examining leadership from within the classroom, a perspective which is limited in prior research.

This research also adds to the larger body of research focused on what is impacting the transformation of our classrooms from traditional classroom models to 21st century learning environments. However, unlike most research that identifies barriers to the change process, this research identified the capacities, behaviors, and attitudes of transformational leadership theory as a catalyst for moving this work forward, and builds a case for professional development programs and courses focused on transformational leadership theory for teachers.

In addition to looking at the transformational leadership characteristics of a teacher, this research looked at the teachers' perception of PD and participation rate in PD as another variable impacting student engagement in the 4Cs. There is a great deal of research showing that professional development will support the transformation of our schools (Hirsh, 2009). For over 8 years, the studied school committed time on a weekly basis for professional development and hired instructional coaches and professional development consulting services to support their staff in transforming their classrooms to 21st century learning environments. Initially, though, change was slow. But over time, the researcher noted that, as participation in 21st century PD increased, so did the transformation of the school's classrooms. Did an increase in participation support the transformation of the school? To gain insight into this, this research gathered the teachers' perceptions of the PD provided to staff that was designed to support 21st century classroom transformation.

Applying the transformational learning theory (TLT) in this research afforded the researcher with a unique opportunity. TLT is defined as learning that has a significant impact on the learner's future work and supports a paradigm shift (Clark, 1993). By

gathering the teacher's perception of the influence PD was having on their classroom lesson designs, the researcher gained insight into whether the existing PD offerings were supportive of the transformation process in the school. The findings showed that teachers who perceived that the PD offerings were impacting their practice showed a significant increase in student engagement in critical thinking, collaboration, and creativity. Therefore, this research suggests that PD should be based on the TLT theory and that districts and schools should develop a growth mindset so that teachers believe that PD can help them transform their classrooms. Otherwise the financial and human resources allocated for this work will not see a return on investment.

Implications of Findings

This research sought to understand if there is a relationship between the transformational leadership characteristics of a teacher (self-rated by MLQ), the teacher's participation in and perception of professional development, and the impact and interaction these variables may have on student engagement in the 4Cs: critical thinking, creativity, communication, and collaboration.

This case study's findings indicate a significant relationship between a teacher's transformational leadership style and student engagement in critical thinking and collaboration. Specifically, teachers who score higher on the transformational leadership scale report engaging students more in activities that focused on critical thinking and collaboration. This suggests that a teacher who possesses and practices transformational leadership characteristics positively impacts student engagement in the areas of critical thinking and collaboration. If we couple that with the research that suggests that a more in-depth focus on enhancing critical thinking skills in K-12 can add academic rigor and

increase student scores on standardized assessments (McCollister & Saylor, 2010; VanTassel-Baska, Bracken, Feng, & Brown, 2009), then we can begin to make a strong case for teachers being transformational leaders in the classroom.

Following that line of thinking, we then need to review the current courses leading to teacher certification. Very few courses discuss and address leadership styles in teacher preparation programs. Primarily the coursework consists of pedagogy or teaching methodology, content-specific courses, and psychology. While these are all an integral part of preparing a teacher for the classroom, this research suggests that if we want to enhance the teaching of 21st century skills (the 4Cs), teacher preparation programs should also engage in instruction around transformational leadership.

Given that the research shows increased student engagement in classrooms where the teacher displays the characteristics of a transformational leader, it is recommended that teachers entering the field of K-12 education learn about transformational leadership theory and assess themselves using the MLQ 6. There are four areas that are important to look at: idealized influence, intellectual stimulation, individualized consideration, and inspirational motivation. After self-rating, each individual teacher can identify which of the four areas they may need to develop in order to grow stronger as a transformational leader.

More importantly, we need to challenge the mindset of those in the political arena, where teachers are viewed as civil servants whose only job is to teach a pre-prescribed curriculum. These political voices are demoralizing the profession and using public schools (and teachers) as a scapegoat for other societal problems (Ravitch, 2007). According to Tom Carroll, president of the National Commission on Teaching &

America's Future, in the US, "there is consensus that we need to not just improve the status but also the performance of the profession, and the two go hand-in-hand" (quoted in Kahadaroo, 2013, para. 4). This study is breaking new ground in suggesting we can improve both the status and the performance, simultaneously, by viewing teachers as transformational leaders and training them to be so.

In Table 2.1, Anderson (2004) shows the important teacher leadership traits that align with transformational leadership theory. This concept would be relatively easy to embed in existing teacher-preparatory courses and would affect the change recommended by the researcher.

Transformational leadership theory is increasing student engagement in critical thinking, collaboration, and assisting in the transformation of our traditional schools to 21st century learning environments. Over time, failure to make this transformation will weaken teaching, weaken learning, damage the learning opportunities for millions, and ultimately weaken societies around the world (Dolton, Adonis, & Schleicher, 2013 p. 4). If we are to improve our classrooms and expedite the transformation our schools, we must enhance our PD and certification courses by infusing transformational leadership into the core requirements.

This case study also showed that teachers who perceived that professional development had a positive influence on their practice made a greater effort to increase student engagement in critical thinking, collaboration, and creativity. This, coupled with research showing that engagement in professional development is crucial to transforming schools and improving academic achievement, supports the need for teacher preparation

programs to develop course offerings that foster a growth mindset and lifelong transformational learning in teachers.

Research states that we need to continually “bolster teacher skills and knowledge to ensure that every teacher is able to teach increasingly diverse learners, [be] knowledgeable about student learning, competent in complex core academic content, and skillful at the craft of teaching” (Hirsh, 2009). While adequate time for professional development is essential, past studies also show that, by itself, more time does not guarantee success (Teaching Tolerance, 2017). This case study found that the hours of professional development a teacher spent in isolation did not have a significant impact on student engagement in the 4Cs but that a high level of transformational leadership capacity on the part of the teacher did have a significant impact on student engagement in the 4Cs.

These findings challenge the current regulations in New York State that require a mandatory number of PD hours for new certificate holders. It also supports a recent report of the American Educational Research Association (2005) that concluded, “While adequate time for professional development is essential, studies also show that, by itself, more time does not guarantee success” (2005, p. 4) As of July 2016, all New York State *professional* teaching certificate holders, must accrue 100 hours of professional development over a 5-year period. The intention is to “promote the professionalization of teaching and educational leadership, as applicable, and be closely aligned to district goals for student performance” (NYSED, 2016) by requiring the hours to be spent studying more content, pedagogy, and training for working with English language learners. The state has provided a list of approved professional development providers for these hours.

However, research is clear that “professional learning—when it’s systemic, where it’s being done as a sustained process inside a school, when it’s ongoing, experiential, collaborative, and connected to students—is more powerful than any video, presentation, or catalogue of workshops” (Walker, 2013, para 9). Yet, these new regulations do not allow the PD to be provided during the workday or at the building level, to be counted toward the 100-hour requirement. That, coupled with this research, suggests that the state should look more at requiring individual teachers to work within their districts and that professional development plans should include coursework on being a transformational leader in the classroom. Such courses would help teachers develop a classroom model supportive of 21st century learning, and they would include time with instructional coaches and hired consultants to improve their lessons and observe their classrooms. These regulations need further study in order to ensure that the goal of making a teacher a lifelong learner is not defined by a series of 1-day workshops that have little or no impact on their classrooms. “Professional learning for educators is a crucial step in transforming schools and improving academic achievement” (Hirsh, 2009, p.3). This advice from Hirsh needs to be taken seriously by policymakers in Albany.

Limitations

This research was a case study of the South Orangetown Middle School. The teachers in the school were extremely familiar with the Partnership for 21st Century and the 4Cs. The faculty, with a 99% retention rate, has been working for over 8 years on integrating the 4Cs into their classroom lessons. For 8 years, both during the summer and as part of the work day, professional development has been provided specifically to support student engagement in the 4Cs. The teachers are not required to attend, but over

80% have participated in some training. There may also be a relationship between the sustained professional development provided by the IDE Corp. Although this PD does not directly address transformational leadership on the part of the teacher, an indirect benefit to this training fosters high levels of transformational leadership in the classroom. The researcher must acknowledge that this work may have had an impact on the results of this study.

This acknowledgment notwithstanding, the purpose of this study was to assess current levels of student engagement and to discover which teachers brought about the highest levels of student engagement and why. It is important to note that prior to this research, there were no discussions or PD around the transformational leadership theory or the characteristics of a transformational leader.

The MLQ short form was used. This is the teacher's self-rating form. As this was a case study in one school, this instrument was chosen to avoid colleagues rating one another. Therefore, the scores used to determine the outcomes of this research were based on the teachers' perceptions. The student perspective was not part of this study and therefore is a limitation to the study. In addition, no teachers' self-ratings calculation was in the low transformational interval. This caused the data to fail the normal distribution test requiring the researcher to apply non-parametric testing.

The 21st Century Survey (Hixson et al., 2012) selected for this research was also based on the teachers' perceptions of their work with students. Therefore, the student voice regarding engagement in the 4Cs is absent in this research. The survey responses were converted to a numerical scale and averaged to calculate one score for each area on the survey. For this research study, only the areas of critical thinking, collaboration,

creativity, and communication were used. As noted earlier, these 4Cs have been discussed and studied for an extended period of time within this school.

Recommendations

One question lingering with the researcher is what caused all of the teachers in this school to score moderate to high on the MLQ transformational rating scale. In reflecting on the prior work within the school, one area to research further is the possible impact of sustained professional development focused on developing a growth mindset and the possible impact this has on the individual teacher's transformational scale. Specifically, is there a relationship between a teacher having a growth or fixed mindset and that teacher's rating on the MLQ scale?

As defined by Dweck (2006), a growth mindset is known as the belief that a person's basic qualities are able to be cultivated through effort. Growth mindset individuals believe in the "transformative power of effort" to actually grow intellectual ability (Dweck, 2006, p. 42). Since this school had engaged staff in identifying their own mindset via an online tool and then provided differentiated PD to support further development of a growth mindset, the researcher recommends further studies to explore how developing a growth mindset in a teacher impacts student engagement in 21st century skills and/or the teacher's transformational leadership scale scores.

In addition, since student engagement in creativity was found to be impacted primarily by a teacher's perception of professional development having an impact on their pedagogy, this may suggest that a teacher's growth mindset supports greater student engagement in generating and refining solutions to complex problems. Teachers with a growth mindset recognize that knowledge and skills arise from effort including a

student's creative powers. Further research should look at the connection between a teacher's mindset and if there is an impact on student engagement in creativity.

Regarding policymakers and teacher-preparation programs, this research challenges these leaders and programs to require leadership courses early in their program. Currently, leadership courses are only part of a master's degree for aspiring school administrators. However, this research builds the case that classroom teachers need to be taught the importance of being transformational leaders in their classrooms. The value of a teacher recognizing and practicing the habits of a transformational leader may raise student achievement scores by fostering student engagement in critical thinking and collaboration.

Furthermore, this research may provide another key support to assisting in closing the achievement gap. Students who are engaged in their education do better on a variety of indicators (Gallup, 2014; Jackson & Zmuda, 2014). They complete high school and are ready for college and the workforce, and they develop a greater understanding of how to be successful citizens and contributing members of a democratic society. Students are engaged in learning grow to be successful adults. This research shows the positive outcome on student engagement in critical thinking and collaboration as a result of the teachers displaying transformational leadership qualities in their classrooms. Further research should look into understand this relationship more fully and possibly investigate the impact in a variety of demographic settings.

The one area not impacted by any of the dependent variables in this research was communication. Teaching, by default, requires communication. This survey defined communication as "students being able to organize their thoughts, data, and findings and

share these effectively through a variety of media, as well as orally and in writing” (Hixson et al., 2012, p.1). The mean student engagement scores for those rating highly transformational was 3.472, and the mean engagement score for those rating moderately transformational was 3.400 out of 5 possible points. While there is no statistical significance between these two ratings, the data indicate that teachers are directly engaging students in communication skills approximately one to two times a week. Research also showed that “there are few well-established practical assessments for interpersonal competencies like communication that are suitable for use in schools, with the exception of tests designed to measure those skills related to formal written and oral communication” (National Research Council, 2012, p. 6-4). It is recommended that future research engage in supporting the development of assessments to assist educators in this area of 21st skill development.

Conclusion

The United Nations Educational, Scientific and Cultural Organization (2013) stated:

Addressing the crisis in quality learning requires us to redefine what education systems are for. The skills, knowledge, values, and attitudes that learning and teaching promote must reflect and respond to the needs and expectations of individuals, countries, the global population, and the world of work today. They must not only teach basic skills, like reading and math, but encourage critical thinking and foster the desire and capacity for lifelong learning that adapts to shifts in local, national, and global dynamics. These diverse learning goals may seem disparate, but are actually synergistic – by encouraging active participation

and emphasizing critical thinking, children's acquisition of basic literacy and math can be promoted at the same time they are gaining necessary skills for the 21st century. (p. 4)

Teachers are at the core of addressing the crisis in quality learning. This research suggests that they will be better able to meet the crisis if they possess the characteristics of a transformational leader with intellectual stimulation, individualized consideration, inspirational motivation, and idealized influence. Students need to learn from teachers who provide individual learning paths. This requires the teachers to develop a series of personalized learning targets for each student, which accounts for their individual strengths and needs. Teachers must provide intellectual stimulation on a daily basis. This requires teachers to develop a plethora of critical thinking activities based on the standards that require students to collaborate, invent, present, and research. Students learn best in classrooms that are filled with inspirational motivation and where a classroom culture of respect results in idealized influence. Students engage when they "feel that they are genuine members of a community, that the group is organized around a clear purpose, when they are treated as valued and respected members of the group, and when they are treated with fairness (Newmann, Wehlage, & Lamborn, 1992). By exhibiting these traits of a transformational leader in the classroom, our teachers will assist our schools in transforming from traditional classrooms to 21st century learning environments, resulting in students being better prepared for college and career.

Even though teachers are at the front lines of this work, policy makers must commit to supporting this difficult but imperative transformation within our schools. Policy makers need to provide professional development to the staff of the state

departments of education in order to explain and promote this critical work. Policy makers should call for the integration of 21st century skills into teaching standards across all disciplines and the development of assessments to support this work. Twenty-first century skills cannot be successful implemented in isolation. Students can only think critically and communicate effectively when they build on a base of core academic subject knowledge. Finally, policy makers must support the development of intense PD programs that focus on both 21st century classroom models, structures, and lessons as well as developing the teacher as a transformational leader committed to lifelong learning. These PD offerings should support K-12 and higher education.

School district leaders need to support this work by building capacity in their school districts that leads to the creation of a school culture of risk taking and collaboration. Time must be allocated for teachers to collaborate and discuss 21st century skill development and methods to increase student engagement in those areas. Teachers need to understand that they are transformational leaders within their classrooms. They should identify what traits on the transformational leadership scale they possess and where they need growth. Developing each trait is critical in becoming a highly transformational teacher leader.

This research opens the door for all educational leaders to shift their thinking about classroom teachers to a model of the teacher as a transformational leader within the classroom who develops opportunities for student engagement in critical thinking, collaboration, creativity, and communication. These four skills were identified by major corporations as missing from the current pool of job seekers. Therefore, it is the responsibility of our schools to support students in developing these skills in order to

secure not only a place for our students in the work force but for our nation's continued growth in the global economy.

This study can serve as a springboard for thinking about teachers leading the transformation of our schools from traditional to 21st century learning hubs that highly engage all students in the 4Cs and break down the walls that keep certain students from achieving their own individual greatness. Providing professional development that supports teachers becoming transformational leaders within their classroom may expedite the time needed for our schools to transform.

This study came about as a result of the researcher's involvement in a reform initiative designed to promote and increase student development of 21st century skills. The research provided valuable insight not only into the work within the researcher's school but advocacy efforts to challenge the political arena to adopt this new vision of the role of a teacher and to revamp and strengthen teacher preparation programs. The ultimate goal of the researcher's work is to make a positive contribution to the field of education and to be an example of a strong transformational leader.

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Appendix A

2014-2015 Goal/Action Plan for South Orangetown Middle School Students

GOAL/ACTION PLAN (principal/building goal related to major district-wide goals)		SCHOOL: SOMS
<i>South Orangetown Middle School students will transition to the high school with the knowledge and experience of utilizing 21st century skills and exploring 21st Century Themes.</i>		DATE: July 2, 2014 THEORY OF ACTION: If we continue to implement “student centered lessons” into our classroom so that all students engage in our lessons then all students will acquire the knowledge and skills to succeed as effective citizens and workers and leaders in the 21 st century.
Approach (Goal with strategies & rationale)	Implementation (Action plans & tasks)	Outcome (results/evidence/assessment process)
Our primary goal is to continue our revisionist practice to Evaluate and/ or Refine our current lesson to further enhance the integration of 21 st century skills/themes in a student-centered interdisciplinary model.	<ul style="list-style-type: none"> • We will continue to move all classrooms into the LATI format through the support of our IDE Coaches. • Every Teacher will “21st Century-Tune” a minimum of 1 unit and actively participate in the “tuning” of a unit throughout the year during department meetings. • Each department will bridge with the CCLS in an interdisciplinary unit. • All staff will participate in the MakerSpace professional development offerings. • Units will be created that extend the classroom into the MakerSpace Lab focused on 21st century skills 	<ol style="list-style-type: none"> 1. Observations will show an increased use of the LATI elements 2. Data will show student growth from Pre-test to Post- test for new /refined Explore Classes 3. Unit Work- To develop and implement new or refined units created through IDE consultation that will show greater evidence of 21st century skill teaching and assessment. These will focus on 21st Century problem – based learning specifically related to the Common Core Standards in ELA and Mathematics. 4. MakerSpace- Increased interdisciplinary teaching related to the CCLS through newly created or adapted units to extend the class into the new MakerSpace to further enhance and teach 21st century skills including 3-D printing.