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Protocol Use in a Professional Learning Community: Teachers' Perceptions of Instructional Design and Understanding of Students' Critical Thinking

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COLLEGE OF EDUCATION

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2013

Abstract

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MA, City University of New York, 2002

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Dissertation Submitted in Partial Fulfillment

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Doctor of Philosophy

Teacher Education

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Abstract

Leaders in business, government, and education have sought to improve students' ability to think critically. While research on professional learning communities (PLCs) suggests PLCs positively impact standardized test scores and teacher efficacy, there is little evidence of how PLCs using inquiry protocols influence teachers' perceptions of instructional design for critical thinking and understanding students' critical thinking. Demands for critical thinking instruction rather than test preparation, plus teachers' misunderstanding of their students' critical thinking, support the purpose for this case study. This study examined how PLCs using inquiry protocols influence teachers' perceptions of instructional design for critical thinking and understanding students' critical thinking. The theoretical framework for this study drew from several theories, its emphasis was on constructivism in PLCs' use of inquiry protocols and critical thinking. PLC participants from an existing PLC agreed to join the study when asked during a PLC meeting. Eleven voluntary participants taught in 3 different grade levels and 8 subject areas. An inductive analysis of participant field notes, transcripts from PLC sessions, and group interviews indicated a divergence in participant understanding. Participants reflected either clarity or confusion in designing critical thinking projects and understanding students' critical thinking. Implications for a positive social change develop as the PLC becomes a model for other classroom teachers seeking to teach beyond state testing mandates. This study addressed the district's perceived need to advance instruction for critical thinking. PLC stakeholders seeking to maximize teacher clarity and minimize teacher confusion around critical thinking may use this study to identify actions to emulate as well as actions to eliminate.

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Dedication

This work is dedicated to my two grandmothers, who would have enjoyed endlessly listening to me discuss my research and my progress. They would have been my greatest cheerleaders through this process and would have been so proud to see it complete. I know now they have been with me all this time, and I could not have done it without them.

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Secondly, I would like to thank my family. To my kids, I hope you can understand how important this was for me to complete and can understand why I was away working on it for so many hours. To Laura, I owe you the deepest gratitude. When I first brought up the idea and was nervous and too scared to proceed, there was no doubt in your voice and your support. You simply said I should do it, period, end of story. You kept me positive when I was down, you listened without judgment when all I needed was an ear to listen, and most of all, you always encouraged me to keep going and believed in my ability to finish.

Lastly, I would like to thank my research group for all you did to make this happen. I would especially like to thank Stephan and Luann for your early support in getting the study off the ground. I would especially like to thank Eli and Linda for your support and engagement in making the group succeed in the later stages. Finally, I offer my deepest gratitude and thank you to Jen for all you did to make this happen and move me through the process. From our discussions on research, to our discussions on the application of research to students and teachers, and finally our countless hours going

back and forth on writing down the stretch run, I will forever be thankful to you in a way words can never do justice. Without you this would never have happened.

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Section 1: Introduction to the Study

It has been almost 30 years since the National Commission on Excellence in Education (NCEE, 1983) called for improving the quality of education in the United States. Since then, states have implemented state standards and high-stakes testing in core subject areas to try to improve the level of education of all students (West, 2005) in accordance with the No Child Left Behind Act of 2001 (NCLB, 2001). The prevailing culture of schools is not conducive to a collaborative environment in which teachers try to improve how they teach critical thinking, as well as how to recognize the demonstration of critical thinking in their students' work (Barth, 2006; Maloney & Konza, 2011). However, efforts to create a collaborative environment for teachers in schools have expanded, in part because of the growth of professional learning communities, a setting in which teachers collaborate on the issues of teaching and learning (PLCs; DuFour, DuFour, & Eaker, 2008). The growth of professional learning communities has also contributed to teachers' increased use of inquiry protocols to examine student work and develop lessons (Dana & Yendol-Hoppey, 2008; McDonald, Mohr, Dichter, & McDonald, 2007). In many communities, like the one under study, efforts to develop PLCs are in their early stages. In its strategic plan, the district under study calls for the development of PLCs but establishes no connections between PLCs and the community's concerns about student learning in the area of critical thinking. This study examined (a) whether teachers working together on a singular focused inquiry can use feedback from protocols, a set of guided group discussion steps for exploring

inquiry questions (Easton, 2009), to influence their instructional design and (b) whether feedback from protocols can influence teachers' understanding of students' critical thinking and have a positive social impact on the quality of teachers' instruction and understanding of how students learn.

Background of the Study

According to Paul and Elder (2007a), leaders' and interest groups' manipulation and packaging of information in the United States have created an environment of "accelerating change, intensifying complexity, escalating interdependence, and increasing danger" (p. 10). Paul and Elder (2007a) contended that critical thinking is important because Americans face a daily glut of this manipulated information, and the majority of people do not think independently and tend to see the world in a polarized manner. Therefore, it is necessary for students in the United States to become critical thinkers who must learn how to take charge of their own thinking to become lifelong learners.

Likewise, Barell (2003) argued that students are too passive in their learning when they accept the information they obtain from their textbooks, classes, and the media in general as fact. Costa (2008) reinforced the need for improved student learning in several ways. When Costa asked teachers how they knew their students needed direct instruction to improve thinking, teachers of all grade levels articulated several weaknesses. Teachers told Costa (2008) that students depended on the teacher for answers, abandoned difficult tasks too easily, and were unable to apply knowledge, take risks, or work together in groups.

NCLB mandated high-stakes testing does little to help students think independently. According to Mansilla and Gardner (2008), knowledge required for state-

mandated tests created disciplined minds in students when broader, integrated disciplined minds were needed. Sergiovanni (2005) argued that standardized testing promotes mediocrity because it squelches both meaningful student learning and imaginative teaching.

Several researchers have argued that to improve the capacity to teach critical thinking schools should develop project-based learning (PBL) assessments and utilize PLC's to structure teacher collaboration (Newmann and Wehlage, 1995; National Staff Development Council, 2001; Rotherham and Willingham, 2009). Newmann and Wehlage (1995) originally recommended that schools use PLCs to build their organizational capacity. In addition, Newman and Wehlage encouraged teachers to develop authentic assessments using PBL which can be used to measure students' critical thinking while also improving teacher pedagogical effectiveness. The National Staff Development Council's learning communities standard also supported the development of PLCs. According to Rotherham and Willingham (2009) if educational leaders were serious about teaching collaboration and self-direction skills, they would use PLCs in a study to better understand how PBLs are used to encourage collaboration and build these authentic problem solving skills for students.

Researchers found teachers benefit from their engagement in PLCs (Annenberg Institute for School Reform, 2004; Caine, Caine, & Renate, 2010; DuFour et al., 2008; Easton, 2009; Maloney & Konza, 2011; Newmann & Wehlage, 1995). However, more research is needed to determine how PLCs impact student learning (Crosby, 2007; Lieberman & Miller, 2011; Riveros, Newton, & Burgess, 2012; Scott, 2012; Vescio, Ross, & Adams, 2008; Weinbaum et al., 2004). Vescio et al. (2008), called for

"additional and rigorous research documenting the impact [of PLCs] on teaching practice and student achievement" (p. 89). Specifically, they called for research examining how PLCs are used in determining the impact of analyzing student work and teaching practices while assessing the qualities of each. This study helps build the body of research to understand teacher perceptions of navigating protocols in a PLC to in order to design instruction for critical thinking and understanding of students' critical thinking. McGowan (2007) recommended a study to pilot a "question protocol designed specifically to investigate teacher concepts of critical thinking by linking them more closely to practice in the K–12 arena" (p. 141). When Easton (2009) suggested that inquiry protocols help to build a culture "essential for collaborative work on issues of substance" (p. 1), this provided an impetus for combining the PLC model with a focused teacher inquiry utilizing protocols. Inquiry protocols provide systematic steps for focusing group discussions around a targeted question. The current study's focus on inquiry around critical thinking further supports the need to investigate how inquiry protocols used in PLCs can influence teaching and learning. Section 2 provides a detailed discussion of relevant literature on PLCs, protocols, and critical thinking.

Problem Statement

Government officials, business leaders, and educators have expressed a desire to improve education for almost 25 years (Assessing and Teaching of 21st Century Skills Project, 2010; Brooks & Brooks, 1999; Common Core State Standards Initiative 2011; Green, 2007; NCEE, 1983; Rotherham & Willingham, 2009). They specifically called for improvements in such areas as critical thinking, problem solving, posing and answering quality questions, and developing an integrated understanding of concepts.

Legislative efforts such as NCLB (2001) have been passed to address student achievement issues (West, 2005).

However, these discussions and NCLB failed to address a fundamental problem underlying education in the United States: students' inability to think critically. Almost 20 years ago, Paul (1995) explained students' fundamental inability to engage in critical thinking could have resulted from teacher's limited ability to engage their students in critical thinking or recognize critical thinking in student work. Deuel, Holmlund-Nelson, Slavit, and Kennedy (2009) suggested that teachers' preconceived notions about students interfered with their ability to determine the extent to which student work actually demonstrates an understanding of critical thinking. Paul and Elder (2001, 2007a) expressed concern about teachers' understanding of students' critical thinking when they stated, "We cannot assume that teachers have a clear concept of critical thinking. Indeed... the opposite is true... evidence suggests that critical thinking is rarely fostered in a systemic way in academic programs at any level" (p. 5). Paul (1995) contended that teachers cannot recognize the "profound difference" (p. xii) between student memorization and regurgitation of others' ideas and the reasoning and conclusions students develop independently based on "their own disciplined thought" (p. xii).

Although teachers and schools want to improve teachers' understanding of critical thinking, inhibiting factors within U.S. schools' cultures prevent teachers from improving student achievement (Deuel et al., 2009; Easton, 2009; Maloney & Konza, 2011). Even though districts spend money on improving curricula and implementing new professional development initiatives they feel are necessary for improvement, their influence in the classroom is often negligible (Choy & Oo, 2012; Sergiovanni, 2005).

Barth (2006) compared the way teachers act in a school to the behavior of very young children. Like children who engage in independent, or "parallel" (Barth, p.9), play alongside one another, teachers act alone within their classrooms. Teachers are often limited to meeting other teachers in a staff lounge or around a copy machine for a few minutes a day, unable to engage in real collaborative work to improve student achievement. Even though teachers intend otherwise, this affective lack of collaboration contributes to ineffective instruction (Schmoker, 2006).

Since school cultures are typically not conducive to addressing the issue of inadequate student achievement, many schools adopt the PLC model (Dana & Yendol-Hoppey, 2008; Danielson, 2006; Maloney & Konza, 2011). While research on PLCs suggests they positively impact standardized test scores and teacher efficacy, the literature provides little evidence of how inquiry protocols used within PLCs influence (a) teachers' perceptions about the design of students' critical thinking projects and (b) their perceptions of students' critical thinking (Annenberg Institute, 2004; Crosby, 2007; DuFour et al., 2008; Lieberman & Miller, 2011; Newmann & Wehlage, 1995; Riveros et al., 2012; Scott, 2012; Vescio et al., 2008; Weinbaum et al., 2004).

In communities similar to the one under study, the concern is not about whether students are passing tests but whether the instruction is rigorous enough to challenge students beyond the recall and knowledge levels needed to pass a standardized test. In highly successful communities, the concern is not about passing high-stakes testing, since passing rates are typically well above the 90th percentile (New York State Education Department, 2011). Rather, the community seeks challenges for students that enhance

their critical thinking skills so that they are better prepared for their next level of education.

The teachers in the middle school where this qualitative case study was completed first articulated their concerns about student weaknesses in grade level team meetings as early as 2005. Teachers examined end-of-year assessments from the previous year and identified weaknesses in critical thinking across multiple content areas. Parents' comments in community blogs, district meetings, and parent surveys also suggested that there were weaknesses in student experiences and in the instruction design of activities within the classroom to promote critical thinking. However, teachers' isolation was similar to the situation Little, Gearhart, Curry, and Kafka (2003) described: Teachers were alone with student work and lacked the capacity to function collaboratively to improve student learning as part of professional development. The district under study structured its goal-setting system ineffectively; it did not guarantee that when teachers collaborated on a goal, the goal was an inquiry into student learning. Even when teachers collaborated on a stated goal, their collaboration was little more than a simplistic discussion about an instructional practice or book study group and had not expressly stated a focus on student learning.

Under these district-level conditions, a group of teachers came together in a PLC to target critical thinking using the inquiry protocol process for their meetings. This study sought to examine how using an inquiry protocol within a PLC affected teachers' perceptions of both instructional design for, and understanding of, students' demonstration of their critical thinking.

Nature of the Study

This qualitative study used a case study design. Because it was necessary to capture teacher perceptions around both teaching and learning, multiple data types were gathered, including field notes of all PLC sessions, transcriptions of PLC meetings, and the transcription of a final group interview. Creswell (2007) stated that case studies require an "in-depth data collection involving multiple sources of information rich in content" (p. 61). Creswell's definition suggested that a qualitative case study was the best approach. This qualitative case study allowed teachers in the PLC to share their perceptions as they occurred in a natural setting. The qualitative approach was preferable to the quantitative approach in which predetermined "factors that influence an outcome" (Creswell, 2003, p. 21) are not readily apparent because a quantitative study would not have allowed teachers to articulate their perceptions as in a qualitative study. The use of predetermined variables would not have provided the desired evidence of depth of teacher understanding. As a result, a quantitative study could not have achieved the desired understanding. The case study design was preferred over a narrative design. Narrative analysis tells a first-hand account of an experience tracing it from beginning to end (Merriam & Associates, 2002). This study did not focus upon an experience that is appropriate to telling a story; instead, this study focused on the perceptions of a group of teachers and the understanding developed as a result of constructing knowledge about critical thinking. Study participants developed perceptions about designing critical thinking projects and lessons. Study participants also developed perceptions about student's critical thinking. Because participant perceptions evolved around instructional design and student's critical thinking, there was no documented start and end point

necessary for a narrative analysis. Rather, the in-depth data collection from field notes, PLC meetings, and a group interview provided the multiple data sources, rich in information, suited for a case study.

I collected three forms of data: (a) transcripts of the audiotapes of the PLC presentations, (b) participant field notes, and (c) transcripts of the audiotaped group interview of PLC members. PLC group members volunteered to present to other members for feedback on a project or student work from a completed project. In all three forms of data participants cited evidence of Paul and Elder's (2007a) 25 critical thinking competencies. Participant field notes were structured to parallel the format of the tuning protocol (Easton, 2009) the PLC followed. I transcribed each PLC meeting, as well as the group interview, and e-mailed these transcriptions to all participants for member checks within a week after they occurred. The participants requested no changes. As I examined these data, I was able to determine teachers' perceptions of the critical thinking in project design and in student work.

The data were analyzed throughout the study. I read and reread the transcripts of the PLC session, as well as completed open and refined coding, in order to determine themes. I designed the focus questions for the group interview based on ongoing analysis of both PLC notes and transcripts. Teachers' responses to these questions allowed me to address the research questions more thoroughly. As themes emerged, I triangulated the data from the three collected pieces to find supportive evidence.

I provide a more detailed description and explanation of the methodology of the study in Section 3.

Research Questions

Two broad research questions were the basis of the study:

1. What influence do inquiry protocols, used in PLC's, have on teacher perceptions of instructional design for critical thinking?
2. How does the use of inquiry protocols in PLC's influence teacher perceptions of students' critical thinking?

Purpose Statement

The purpose of this qualitative case study was to explore teacher's experiences using inquiry protocols to determine teacher (a) perceptions of instructional design aimed at critical thinking and (b) understanding of students' critical thinking. The study followed the work which a PLC began during the 2008–2009 school year. The study's 11 participants were part of a voluntary PLC group that voluntarily formed to support a district initiative to develop PLCs. The members included sixth-, seventh-, and eighth-grade teachers from eight disciplines. The PLC worked collaboratively to pilot the use of inquiry protocols during their meetings to develop PBL exercises using Newmann and Wehlage's (1995) seven criteria for authentic assessments. The participants used Paul and Elder's (2007a) 25 critical-thinking competencies to evaluate critical thinking in student work and teachers' instructional design efforts. During the 2010–2011 school year, the PLC explored the influence of using an inquiry protocol, for structuring the meeting and managing the process for questions, on how teachers perceived the instructional design of critical thinking projects for students and how they understood students' critical thinking.

Conceptual Framework

The district under study had a strategic plan that called for the development of PLCs. Yet, none of these PLCs addressed the general community's concerns about the use of critical thinking to promote student learning. A concerned group of teachers working together to address a perceived issue in teaching and learning created a PLC. The community of teachers in this study utilized a constructivist approach to learning in order to share ideas and understandings. The constructivist approach is based upon the cognitive learning theories of Dewey (1916), Piaget (1952) and Vygotsky (1962, 1978). The constructivist approach guided study's participants as they wrestled with the perceived district issue of advancing critical thinking in their teaching and students' learning. This study helped to combine the district administration's desire to develop PLCs with the teachers' and parents' desire to address a weakness in students' critical thinking. Throughout this study, data were obtained to help build an understanding of how a PLC using protocols influences teacher perceptions of instructional design of critical thinking projects and teacher understanding of students' critical thinking. Protocol use provided the teachers a focused structure to frame their learning and discussions to help maintain a safe and comfortable environment for all participants in the PLC.

Definition of Terms

The following terms were used throughout the research and are defined for the purpose of this study.

Action research: Action research is the term often used to describe teacher research or teacher inquiry. Cochran-Smith and Lytle (1993) defined action research as

teachers' systematic, intentional study of their practice within the confines of their classroom. Dana and Yendol-Hoppey (2008) gave a more precise definition to include teachers who identify research questions and then use their questions as the basis for their work. The teachers gather relevant literature, collect and analyze student data, and then make changes in their practice to reflect their findings.

Backwards design: Wiggins and McTighe (2005) described backwards design as the development of a specific instructional goal that can include content and skills. Teachers use the goal to determine acceptable performance levels and then work backwards to develop instructional plans to achieve the goals.

Collaborative inquiry: Collaborative inquiry is defined as teachers coming together to develop and answer questions about their students. They gather data, reflect upon the data, and then take action to affect learning and instruction. The teachers use the other members of the inquiry group as experts as they reflect, critique, and coach one another to improve each group member's overall teaching and learning (Weinbaum et al., 2004). Cochran-Smith and Lytle (1999b) further stated that when teachers engage in collaborative inquiry, they turn their classrooms into data collection labs to question their own and others' teaching.

Constructivism: Fosnot (2005) stated that constructivism is the development of deep understanding that results when cognitive imbalance occurs. As students grapple together in open discussion with new, complex information, they compare their own understanding with the understanding of those around them. Errors and misunderstandings are not avoided but used as tools for reflection to advance learning and understanding. Constructivists contend that deepening understanding leads to

cognitive development rather than identifying development as the precursor of understanding.

Critical thinking: Willingham (2008) defined critical thinking as "a subset of three types of thinking: reasoning, making judgments and decisions, and problem solving" (p. 11). Critical thinking has "three key features: effectiveness, novelty, and self-direction" (Willingham, 2008, p. 11). Students think effectively when they see more than one side of an issue, avoid allowing emotion to sway their views, and use proper evidence to support their views. Students think in novel ways when they reach a self-directed solution, one in which they "call the shots" (Willingham, 2008, p. 11) to handle a problem instead of relying on a previously learned solution or process. Paul and Elder (2006b) further stated that critical thinking requires three interwoven phases: analyzing, evaluating, and improving thinking. In a given situation, critical thinkers analyze the parts of the situation, "its purpose, question, information, inferences, assumptions, concepts, implications and point of view" (Paul & Elder, 2006b, p. xiii). Critical thinkers evaluate when they are able to recognize strengths and weaknesses of their own thinking. They must use the intellectual standards to evaluate how much of their thinking is "clear, accurate, precise, relevant, deep, broad, logical, significant and fair" (Paul & Elder, 2006b, p. xiii). Lastly, critical thinkers improve their thinking when they maximize its strengths and minimize its weaknesses.

Inquiry protocol: Easton (2009) stated that an inquiry protocol is a constructivist approach utilizing structured, conversational steps. Teachers use protocols to explore student work or issues related to teaching and learning. Teachers follow guided steps to conversations with specific, targeted goals for providing feedback, and know when to talk

and when to listen. A hallmark of the protocol process is the time limit incorporated into the process, allowing for a final reflective process at its conclusion.

Inquiry stance: Cochran-Smith and Lytle (1999a) defined an inquiry stance as a specific opportunity for teachers to come together to improve their practice. When teachers engage in an inquiry stance, they question what they do through a focused study applied to the unique situations of each learning community in which they operate.

Professional learning community (PLC): DuFour, DuFour, Eaker, and Many (2006) defined a professional learning community as a group of teachers working together to achieve a common goal of learning. The group engages in continuous learning to achieve results rather than concerning itself with intentions.

Project-based learning (PBL): Mergendoller, Markham, Ravitz, and Larmer (2006) defined project-based learning as an extended task the teacher designs. This task compels students to answer a complex question and requires students to learn essential knowledge and skills in order to complete the project. Students are immersed in an experience that mimics the real-life knowledge and skills central to the discipline outside of a classroom (Larmer & Mergendoller, 2010; Mergendoller, Larmer, & Ravitz, 2003).

Assumptions, Limitations, and Delimitations

Assumptions

An assumption of the study was that the PLC participants were able to establish a productive level of trust. Group members had to be open, honest and willing to give and receive constructive criticism. Only if trust were established could the group offer and accept feedback within the protocol that was productive and honest in informing their instructional design and understanding students' critical and higher order thinking.

Limitations

This study was subject to 4 limitations. First, even though the teachers in the PLC agreed to use it, the PBL model became a limitation of this study because participants' years of teaching experience impeded their ability to understand and manage the complex nature of PBL. Teachers' comfort and years of experience with the instructional use of technology influenced both participants' perceptions and their descriptions of students' experiences with PBL. Participant teachers with limited comfort and/or experience teaching with technology found that both their understanding and development of instructional design for PBL and students' critical thinking were narrower and generally more confused than those participants who also sought to incorporate technology into projects. A second limitation was that some participant teachers expressed the perception that the PBL approach was conducive to certain subject areas but not others. Consequently, the teachers who felt PBL was less appropriate for their subject area seemed to indicate the quality of projects students completed in their subject areas were naturally of a lesser quality then could be achieved in other, more conducive subject areas. Another limitation of this study was the classroom management styles of teachers in a PBL environment. Teachers who built a strong environment of student self-direction as part of their classroom management style had clearer perceptions of both their design of critical thinking projects and their understanding of their students' critical thinking when compared to teachers who did not have such a style. Finally, group members' participation in the PLC sessions was another limitation in the study. Participants who made PLC sessions a scheduling priority and could therefore attend all or most sessions developed a more constructivist learning of critical thinking than those teachers whose

participation was less consistent. As teachers gave presentations or actively provided constructive feedback to presenters, their perceptions about the way critical thinking projects were designed and about students' understanding of critical thinking were significantly different from the perceptions of those who were less actively involved.

Delimitations

A delimitation of this case study included 11 teacher-participants in a suburban middle school setting who voluntarily joined a PLC. The agreed upon scope of the PLC was a similar interest in critical thinking and the use of PBL as a methodological approach for evaluating critical thinking. Only teacher-participants who voluntarily expressed the interest in PBL and the PLC critical thinking work were included.

Teachers who desire to develop an understanding designing for critical thinking in instruction and developing an understanding of student's critical thinking will find this study relevant to their teaching. This study can potentially apply to a broader range of readers because it examined a wide variety of teachers' work experience, student populations, and subject matter.

Significance of the Study

The study is significant to the practice and understanding of teachers in the school and district in which it was conducted, as well as other districts whose teachers seek to understand how a PLC can help teachers design for critical thinking and understand student's critical thinking in order to improve their practice. Participants gained an understanding of the influence that PLCs using an inquiry protocol have on designing for critical thinking instruction and understanding students' critical thinking. Teachers engaged in PLC discussions incorporated specific critical thinking

recommendations into project design and expanded their understanding of student expressions of critical thinking. These understandings can be shared with other teachers to impact their instruction. Participants expressed a desire to expand their influence by presenting to a larger community, extending as far as regional or national conferences. Teachers embracing a PLC can use a focused inquiry to make their passion for student learning a reality.

The study's implications for positive social change are two-fold. This study advances teachers instructional practice through (a) participants gained shared pedagogical knowledge of supporting the design of critical thinking tasks for students, and (b) the advancement of teacher understanding of students' critical thinking. The participating teachers' expanded understanding extends to others as they engage teachers in collaborative projects and share their new understanding at departmental and school-wide meetings. As teacher understanding about PLCs grows, the PLC's singular focus addresses the school and district concern that teaching should not solely aim to improve standardized test scores. The PLC's focused inquiry upon critical thinking helps alleviate the conceptual gaps in teacher's understanding of critical thinking (Paul and Elder (2001, 2007a). School districts similar to the one in this study, namely those interested in advancing students' critical thinking through quality instruction, can use this study group's perceptions to help advance their own understanding around critical thinking instruction and understanding of student critical thinking levels. Likewise, similar districts could use this study to avoid issues that restrained participants in this study.

Summary

This qualitative case study examined how teachers within a suburban middle school PLC utilized an inquiry protocol to help design projects and understand students' learning in the area of critical thinking. Teachers from a variety of grade levels and subject areas comprised the PLC. The PLC comprised of teachers from a variety of grade levels and subject areas. At each PLC meeting, an individual participant presented either a project under design or a piece of student work from a previously completed project. During participant presentations and subsequent discussions, participants recorded field notes as they followed the inquiry protocol. Field notes and participant discussions focused upon 25 critical thinking standards utilized by the PLC. Each PLC meeting was recorded and transcribed. An inductive analysis was completed to determine emerging themes. The emerging themes guided the focus questions participants answered in a final group interview. Themes emerged through the triangulation of the data pieces: the final interview transcript, presentation transcripts, and participant field notes.

Section 2 reviews the literature on the theoretical foundations and descriptions of PLCs and PBL, as well as the foundations of teacher inquiry, protocols, teacher research, and backwards design as methods for developing the PBL activities. The constructivist learning theory, which ties all other components together, is explained. Section 3 describes the qualitative case study methodology. Section 4 addresses the findings of the study and Section 5 discusses the conclusions and recommendations.

Section 2: Literature Review

Introduction

The purpose of this study was to explore the influence of a PLC, using a protocol, on teachers' perceptions of (a) the instructional design for critical thinking and (b) students' critical thinking. The purpose of this section was to identify and understand previous work on protocol use in a PLC and relevant concepts. The following topics are covered: constructivist learning theory, teacher inquiry, teacher research, collaborative coaching, the use of protocols, how student's understanding and think critically, the Understanding by Design instructional framework, and problem-based learning.

In order to complete a review of research to develop Section 2, I used the libraries at both Lehman College and Walden University. I used the following keywords to identify journal articles and other literature: *constructivism, PLCs, protocols, inquiry, instructional design*, and *critical thinking*. I used the following databases to conduct my search and retrieve journal articles: Academic Search Premier, Dissertations and Theses, Dissertations and Theses at Walden University, Education: A Sage Full-Text Collection, Education Research Complete, and ERIC.

Origins of Constructivist Learning Theory

Some of the most well-known educational theorists helped build the constructivist theory of learning. Dewey's (1916) views laid some of the groundwork for constructivism. In early chapters of *Democracy in Education*, Dewey called for students to engage in discussions with other members of their community to construct their own knowledge through negotiation. Dewey supported the idea that students construct knowledge through their experience with the subject matter. Dewey's views helped build

the foundation for constructivism. Later in the century, child development researcher Piaget supported Dewey's assertion.

Piaget's (1952) findings on children's cognitive development provided a further foundation for constructivism because they demonstrated how a child's cognitive growth moves through stages from concrete to more abstract knowledge and understanding. This cognitive growth, according to Piaget, allows a child to create a *schema* (p.417). According to Piaget, the schema is how the human brain organizes information and assimilates new information. An individual has, in essence, a web of knowledge organized as a series of interconnected webs, or *schemata* (418). Piaget explained the formation of schemata through the example of a young child's cognitive organization of the concept of a bird. Piaget explained how a young child first learns the word *bird* and then, once the child has observed a bird on several occasions and in similar situations, the child develops the schemata for the concept of a bird. The child's schemata of a bird might include characteristics such as these: birds have feathers, lay eggs, have beaks, and fly. As pieces of information are assimilated, the schemata grows but is not fundamentally altered. This growth, according to Piaget, is much like adding air to a balloon. The schemata grows like a balloon as the child incorporates new information, or air, into the existing understanding. Caine et al. (2010) referred to this change in the brain as "neural plasticity" (p. 170). Learning becomes part of the physiology and embedded into the child's brain (Thompson, 2007).

Piaget (1952) later postulated that the introduction of either a more complex situation or contradictory information caused a sense of confusion for the child. Piaget called this type of confusion *disequilibrium*. Piaget's example of the bird schemata

explains what happens when a child obtains new information that does not fit into the existing schema. The child's previous knowledge and experience prove false and force the child to reconfigure knowledge and experience. In the example of the bird, when the child is shown a penguin or an ostrich, the child's existing schemata does not allow the child to apply the term *bird* to an animal that does not fly. Consequently, the child must reconstruct the existing schemata to accommodate the new knowledge. The contradictory knowledge causes disequilibrium for the child, which forces the child to reconfigure the existing schemata, or relearn the term *bird*. If the new schemata are still in agreement with other connective schemata, then the information will be complete, as will the child's cognitive growth. Piaget called this process *accommodation*. As the child develops new and advancing knowledge, schemas grow and the child moves through Piaget's cognitive developmental stages.

A half a century later, Lambert et al. (2002) and Gopnik and Wellman (2012) claimed that Piaget's arguments were too individualistic. These critics argued that social interactions influence human learning to a greater extent than Piaget described. After Piaget, theorists argued that individual cognitive growth, or assimilation, of new information is more dependent upon socially interactive learning opportunities than Piaget's individualistic interpretation (Vygotsky, 1962, 1978; Bruner & Haste, 1990). As a result, many now consider Piaget's systematic view of the growth of human developmental understanding as too rigid and sequential.

Bruner and Haste's (1990) and Vygotsky's (1962, 1978) work emphasized the influence of social interactions on learning for constructivism, particularly the social nature of learning in children. Bruner and Haste's contention was that children's learning

depends on the social situation they are in or on their "cultural and historical context" (p. i). Consequently, children's perceptions and learning depend on the social factors of their culture or the era in which they live. Cobb (1991) went so far as to argue that even within one culture, the meaning one person attributes to a common word may not be identical to the meaning another person attributes to the same word. "It is one thing to assert that, as far as one's experience goes, the meaning others attribute to a word seems to be compatible with one's own, but quite another to assume that is has to be the same" (Fosnot, 2005, p. 6). Even within a classroom, students from similar socioeconomic or ethnic backgrounds may attribute slightly or greatly different meanings to the same word.

Vygotsky (1978), like Piaget (1952), supported the idea that challenging students' understanding promotes their cognitive development. Vygotsky, however, addressed the process of learning instead of the organization of information. Vygotsky believed that encountering discrepant information challenges the individual's previous learning and understanding. However, the ability to learn, which he defined as the ability to solve a problem independently, is dependent upon a child's "zone of proximal development" (p. 86). If a teacher presumes a child is approximating a new developmental stage, the teacher may need to assist the student in solving a problem in one or more ways. A teacher might offer one of the following assistive strategies: provide a leading question, demonstrate a process to solve the problem, or provide the few first steps necessary to solve the problem. Educators refer to these assistive measures as *scaffolding* the learning for the student. This assistance, scaffolding, helps the student assimilate the new knowledge. The more complex the new concepts are, the more likely the individual needs scaffolding to assimilate the information. The closer the individual is to the next

developmental stage in cognitive development, the less scaffolding the individual needs. Vygotsky explained the results of scaffolding as follows: “What a child can do with assistance today she will be able to do by herself tomorrow” (p. 87). As students experience more, they move closer to the next cognitive stage.

Individuals also negotiate new understanding and evolve cognitively through social interactions with others (Gopnik and Wellman, 2012). Peers can also provide scaffolding through social interactions. Students negotiate their understanding with others through language and their prior experiences. These interactions may be between peers, with a mentor, or with a teacher. Vygotsky (1978) argued that social learning is the most valuable learning experience children can have: “Children are capable of doing much more in collective activity or under the guidance of adults” (p. 88). The student’s learning “awakens” (Vygotsky, 1978, p. 90) a new zone of proximal development “that is only able to operate when the child is interacting with people in his environment and in cooperation with his peers” (p. 90). However, one cannot assume the child’s mental development will be consistent from one school subject to the next: “There exists within the child a variety of developmental levels within subject areas” (Vygotsky, 1978, p. 91). This socialization of both learning and negotiated understanding is a key component of the constructivist learning theory.

Constructivism

Several key beliefs shape the constructivist approach to student learning. According to Lambert et al. (2002), constructivism is unique because of the following elements:

1. Knowledge and beliefs form within the learner.

2. Learners personally instill experiences with meaning.
3. Learning activities should cause learners to gain access to their experiences, knowledge, and beliefs.
4. Learning is a social activity enhanced through shared inquiry.
5. Reflection and metacognition are essential aspects of constructing knowledge and meaning. (pp. 26–27)

Fosnot (2005) synthesized these constructivist principles into three themes:

1. Learning is an individual interpretation.
2. Learning is subjective to one's environment.
3. Learners construct meaning through negotiation. The negotiation continues until individuals are satisfied with how other individuals' responses correlate to their own meaning.

Because Piaget (1952) influenced the first two elements of Lambert's (2003) description of constructivism and the first theme of Fosnot's (2005) description of constructivist principles, these elements are precisely defined as cognitive constructivist elements. Cognitive constructivism examines how the individual organizes information to make sense of it. Understanding and knowledge are specific to each individual; therefore, knowledge is "the result of our own perceptual activities and therefore specific to our ways of perceiving and conceiving" (Fosnot, 2005, p. 4). The individual does not understand knowledge as it actually is "but as the individual's previously constructed perceptual and conceptual structures allow" (Fosnot, p. 5). Fosnot argued each individual's knowledge and understanding are dependent upon the development and organization of individual schema and schemata. Fosnot believed an individual creates

knowledge within the organization of one's schemata. Because each person organizes information differently, cognitive constructivists like Fosnot focus on how each individual organizes information so the individual can utilize information to gain knowledge through social negotiation with others. Constructivist teachers, therefore, do not impose meaning on learners because they do not presume that students wait for knowledge. According to Fosnot,"The task of the educator is not to dispense knowledge but to provide students with opportunities and incentives to build [knowledge] up" (p. 7). The constructivist knows that students have their own experiences and understandings and are free to use them to build their own learning and advance their own schemata.

Lambert's (2003) third and fourth elements of constructivism and Fosnot's (2005) second and third themes are better characterized as social constructivism and reflect Bruner and Haste's (1990) and Vygotsky's (1978) influence. Teachers use Lambert's elements and Fosnot's themes to construct challenges or problems that will require students to reorder their own understanding and construct new knowledge as they share and question their own learning compared to the learning of others. The process of learning becomes a social endeavor that challenges each individual's understanding of the world.

An individual's perception or knowledge of something is minimized if one cannot understand it in relation to how others understand it. Students gain individual, cognitive understanding of an idea or concept when they know it in isolation, but do not know how their understanding relates to others understanding of the same concept or idea. Students gain social understanding of an idea or concept when they compare their understanding of it to others' understanding (Fosnot, 2005; Lambert, 2003). As individuals express

their understanding of information, as it exists in their schemata, they must negotiate with others to demonstrate real knowledge. Until the individual comes to share knowledge through negotiation and eventual agreement with others, there is no such thing as common understanding.

Constructivist Implications

The constructivist implications on teaching entail several key components. According to Hannafin, Hannafin, and Gabbitas (2009), several principles affect the pedagogical climate of a constructivist classroom. The constructivist teacher designs tasks with open-ended questions so students are able to engage in a variety of ways. Caine et al. (2010) referred to this as a "messy classroom" (p. 17) in which "body, brain and mind must all be engaged in the learning" (p. 17). The authors further suggested that as the student learns, a combination of practical application and academic knowledge comes together to challenge the student's knowledge and skill range. Students and teachers engage in meaningful dialogue to answer complex issues and questions in a constructivist classroom. The traditional correct answer is not valued; instead, the constructivist teacher seeks students' answers that articulate thinking and understanding to achieve the goal of constructing knowledge. This construction of knowledge brings about sustained, internalized learning in which students interact with their learning instead of simply memorizing a few facts for a test.

The constructivist teacher designs tasks around big ideas that evoke student-centered engagement in learning (Hannafin et al., 2009). Hannafin et al. described teachers' planning and students' learning. Constructivist teachers do not depend on textbooks or workbooks; instead, they replace them with primary sources, raw data, or

manipulative materials for students. Students grapple with, ponder, and discuss these resources in an effort to construct meaning. As students investigate resources, they formulate a broad question that becomes their learning goal. Individual students construct understanding based on their individual schemas. Each student's understanding evolves according to individual ability rather than set, prescribed content. The teacher acts as a facilitator to provoke student thinking based on student preconceptions or current understanding. The teacher does not teach a list of facts all must know for the traditional test. Through their construction of knowledge, students instead retain and internalize learning for sustained periods, building upon their schemas. Student assessment becomes a combination of teacher observations during student work and student exhibitions of work that replicate real-life situations. Students demonstrate their understanding of what they know through an authentic task rather than a teacher's test.

Constructivist teachers also design instruction emphasizing the role of affective learning. As teachers design complex tasks requiring students to engage in social learning, their students' learning improves because of the emotional relationship to new learning experiences (Kafai & Resnick, 1996). As Kusche and Greenberg (2006) contended, the schema contains not only descriptive knowledge but also emotional connections to the knowledge. An individual learns based on the way an individual feels at any given time. Individuals' feelings contribute to the manner in which they compartmentalize information, which affects individuals' understanding of and ability to use information. Therefore, constructivist teachers must foster positive social settings in which learners develop understanding and success together and reflect upon their learning successes so they can deepen their learning (Costa, 2008).

Professional Learning Communities

DuFour et al. (2008) identified several characteristics needed to build the foundation for a PLC. The first characteristic of a PLC is its alignment with the mission of the school. Teachers in a PLC embrace collective responsibility for student learning. They ask a fundamental question capturing the inherent beliefs of people within a school to guide their thinking and actions. This question not only provides a sense of purpose to the teachers in the PLC, it defines the mission of the school. For teachers in a PLC, the answer to this question squarely focuses on student learning.

In schools without a PLC, teachers have one of three common assumptions about student learning (DuFour et al., 2008). First, they assume students learn based solely on their ability. Second, they assume students will learn if they take advantage of the opportunities teachers provide for them. Finally, they assume students learn based on both their ability and willingness to take advantage of opportunities teachers provide for them. In each instance, the student is responsible for learning, while no professional within the school is accountable for student learning. In a PLC, the mission of the school and its teachers is to ensure student learning, not to lay blame (Hord, 2004).

For individuals within a PLC, the onus of learning shifts. No longer do the professionals within the school assume students are responsible for their own learning. In a PLC, the school's or teacher's perception is not that a teacher's job is to teach and the students' job is to learn (DuFour et al., 2008). Teachers in a PLC do not blame students when students do not learn. In a PLC, teachers set high standards for student learning and maintain that all students will achieve their expectations. Teachers within a PLC believe that, with time and assistance, any student can learn and meet the highest

expectations. To help schools and teachers articulate their mission, a PLC must collectively address four basic questions:

1. What do we want students to learn?
2. How will we know when students have learned?
3. How will we respond when students do not learn?
4. How will we respond to proficient students? (DuFour et al., p. 183-84)

To support the answers to these PLC questions, DuFour et al. (2008) and Hord (2004) supported the development of a collaborative effort to devise a vision for the school in which the members of the staff reach consensus about where the school is going. The staff of a PLC develops a vision that defines practices, procedures, relationships, results, and climate of the school they wish to become (DuFour et al., 2006). A benefit of a clear, shared vision is the communal energy and universal focus that guides every action. Group members maintain high expectations for staff and student achievement that resonate and therefore keep everyone moving forward with purpose (DuFour et al., 2008). Scouller's (2012) findings supported making staff members a part of the vision of the school. When the staff was not involved in the construction of the mission statement, the statement had a limited impact upon the teachers' pedagogy and the curriculum taught within the school. Scouller's findings also suggested staff members follow leaders who involve them in the creation of a mission statement. Social constructivists argue that a school should not arbitrarily issue a vision statement without teachers' input and then expect teachers to apply it (Scouller). The social constructivist believes that individuals have to develop both an intellectual community and emotional attachment to a vision statement. When teachers' hopes and

dreams connect to a school's vision statement, it becomes more authentic for them (DuFour et al., 2008). When the individuals within the school form an emotional attachment to a vision, they can embrace it. Reason and Reason (2007) used LeDoux's brain research as support when they asserted that, if teachers have no emotional connection to a mission statement, the statement will not resonate and will eventually fail.

DuFour et al. (2008) described another characteristic of a PLC as its vision or shared vision. In a PLC, a collaborative culture develops in which teams of teachers work together or a whole staff comes together to articulate which actions will result in an improved school. In a PLC, the isolated teacher, who works alone to diagnose student learning and then determines how best to remediate or accelerate it, becomes obsolete. In a PLC, teachers come together to embrace collaborative inquiry in which they identify key elements to guide their thinking and actions (Chappuis, Chappuis, & Stiggins, 2009; Weinbaum et al., 2004). In PLCs, groups of teachers identify student learning issues that drive their purpose and spur their passion for exploration. While a later section addresses teachers' collaborative inquiry in more depth, the basic premise of collaborative inquiry is that groups develop action research to help build their professional knowledge through embedded research, not assumption. Caine et al. (2010) defined action research as a process in which a team works in concert to articulate a problem and collectively solve it. Teachers collect and reflect on data to help productively guide the team's actions while determining a solution.

As part of their collective work, teachers in a PLC also target one final characteristic: goals. The goals guide teachers on a daily basis and allow them to focus

on the main concern, gauge their success, and maintain a sense of purpose (DuFour et al., 2008). Eisler (2012) stated groups developing goals together have increased motivation and are more likely to improve performance. PLCs use the focus their goals create to analyze uneven performance levels within the group and work to establish the highest standards for all members. Lastly, the action orientation of a goal can help connect seemingly unrelated and different knowledge domains, which, in schools, are differing subjects or grade levels. The collaborative groups utilize protocols to guide their actions and thinking as they evaluate student learning with respect to stated goals. They seek best practices and focus on evidence of student learning rather than on teaching.

The focus on meeting real goals requires a shift from the use of summative assessment to formative assessment (DuFour et al., 2008). Teachers within a PLC design common formative assessments to evaluate student learning and set the stage for improvement of that learning. In order to understand the need to change from summative to formative assessment with regard to goals, one must understand how the two forms of assessment are different. In a traditional setting, students take a summative assessment that gauges their learning at the end of a unit, the teacher records the grade using a bell curve, and then the class moves on to another unit regardless of student learning. McLaughlin and Talbert (2006) characterized schools using summative assessments without conversations about instruction and student learning as "weak professional communities" (p. 18). In their study, McLaughlin and Talbert even found instances in such schools when teachers spoke of their high failure rates as evidence of their commitment to high standards for student achievement.

However, in a PLC, teachers give formative assessments, assessments given throughout a unit of study instead of at its culmination, to identify student learning difficulties so that they can give students the time and opportunity for added instruction (DuFour et al., 2008). Teachers do not design formative assessments to penalize the student with identified learning difficulties. Instead, formative assessments provide the teacher with the opportunity to reteach and therefore allow students to get additional practice opportunities so they can successfully demonstrate their achievement of desired learning goal (DuFour et al., 2008; Heritage, 2008). PLCs challenge prevalent views about the teacher's role as the sole disseminator of information as well as the idea that some students just will not learn.

To build a staff into a PLC, school leadership must cultivate the environment in which PLCs can grow (Chappuis et al., 2009; Wenger et al., 2002). School leaders can demonstrate the value of learning groups when they provide the time and needed resources to complete work together, encourage participation, and remove distracting barriers. However, Wenger et al. (2002) cautioned that the process must be a negotiation:

> Your power is always mediated by the community's own pursuit of its interest. You cannot violate the natural developmental processes and dynamics that make a community function as a source of knowledge and arbiter of expertise, including members' passion about the topic, the sense of spirit and identity of the community, and its definition of what constitutes expert performance. Rather, you must learn to understand and work with these processes and dynamics. (p. 14)

School leaders who wish to build a PLC should heed DuFour et al.'s (2008) advice and build their mission, vision, values, and goals over time to a "critical mass" (Chappuis et al., 2009, p. 59) that enables a strong, unified effort to seek improvement.

Teacher Research and Collaborative Inquiry

The potential benefits of collaborative inquiry groups indicate that schools and teachers should make them a sustained part of their professional experience. In describing the benefits of the 21st-century skills movement, Rotherham and Willingham (2009) stated that one of the most desirable outcomes of the movement is the goal of increased teacher collaboration because without it, an invaluable resource in schools is lost. Research suggests a prevailing belief that strong ties exist between student success and strong teaching (Scholastic & Bill and Melinda Gates Foundation, 2012). The research also suggests that teachers' actions outside of the classroom will strongly influence what they accomplish inside the classroom. Teachers who choose to engage in an inquiry stance can come together to analyze student data, question assumptions and practices of themselves and peers, discuss pedagogy to optimize success of all students, and maintain sustained professional development that will impact the students across a school.

Collaborative inquiry groups allow teachers to claim ownership of their practice and engage in leadership actions that can influence others to raise their level of teaching to demonstrate true professionalism (Chappuis et al., 2009). Teachers frequently ask students to work collectively because they understand that when students work together, they bring a greater collection of knowledge than when students work alone. Yet, rather than working collectively, teachers frequently shut themselves into their own classrooms

and engage in the very behaviors they admonish students for engaging in. Danielson (2006) referred to the need for collaborative work as de-privatization of a culture that according to Deuel et al. (2009), typically embraces privacy and professional isolation. Barth (2001) argued that teachers should be modeling the type of communal learning they seek from their students. He further suggested that the most meaningful learning of all occurs when individuals know they do not know something, and then seek to know it because it will significantly impact the lives of others.

Teachers who form inquiry groups empower themselves when they break out of the isolation that pervades their thinking to ensure student learning becomes the most important shared goal. Inquiry groups can cause great apprehension in teachers accustomed to the safety of individual classrooms (Danielson, 2006; Darling-Hammond & Richardson, 2009). To ease teacher apprehension, Danielson (2006) believed teacher leaders must emphasize the purpose of an inquiry group is to examine student results, not to critique teachers. This concerted effort equates to better student outcomes because as teachers share their findings and experiences, they expand their influence to the improvement of fellow teachers within their collaborative inquiry group and as well as others outside of the group. A true collegial setting emerges in which teachers create a safe, sharing environment of mutual aid where all embrace learning as their responsibility and share leadership to improve practice (Darling-Hammond & Richardson, 2009).

Teacher Inquiry

Teachers who engage in inquiry function under the assumption that teachers are professionals and can benefit when they act in a professional capacity (Darling-Hammond & Richardson, 2009; Weinbaum et al., 2004). Collaborative teacher inquiry is

unique because teachers rely on one another instead of external forces to define and explore issues and problems.

In order to engage teachers in inquiry, one must accept several philosophical assumptions about teachers (Brighton, 2009; Riveros et al., 2011). The first assumption is teacher expertise begins with their classroom experience, but it truly develops through discussions and analysis with fellow teachers. Darling-Hammond and Richardson (2009) argued for professional development that allows teachers to gain new knowledge, put it into practice, and specifically reflect upon it with colleagues. Through this kind of collaborative professional development, teachers are able to identify issues with their own students and develop ways to deal with those issues. Through their work together, teachers obtain benefits that help their professional growth. When engaged in collaborative inquiry, teachers gain fresh insight from other professionals' feedback to help them solve old problems they could not solve independently. Caine et al. (2010) claimed that teachers seek the opportunity to experiment and learn from mistakes and accomplishments in open, honest discussions with colleagues within a safe environment free of evaluation. Through teacher collaboration, teachers find a sanctuary of high-level discussion in which they can dissect their practice to evaluate and analyze their effectiveness without concerns about their professional status. Their purpose is to share work and help each other rather than evaluate each other. Weinbaum et al. (2004) went so far as to say that collaborative inquiry also helps to renew teachers' commitment to professionalism because it allows teachers to break out of the isolation that often permeates teaching.

Researchers have consistently identified issues that can impede the development of inquiry among teachers (Caine et al., 2010; DuFour et al., 2008; Hord, 2004; Scholastic & Gates Foundation, 2012; Weinbaum et al., 2004). One significant issue teachers face is the lack of time to engage in inquiry during the school day. Placing additional burdens on teachers after the school day has ended cannot build inquiry, so administrators must ensure teachers do not feel inquiry is an additional burden (DuFour et al., 2008; Hord, 2004). Yet, Deuel et al. (2009) stated that more often than not, administrators do not provide teachers with any real guidance or leadership, so teachers are left to their own devices to maintain effective collaboration.

Another issue that can impede inquiry is a lack of community (Weinbaum et al., 2004). A lack of community is based on a fundamental lack of trust that influences a staff's actions. Caine et al. (2010) referred to a need for general buy-in, which is essential for success. Because lack of trust impedes open communication necessary for inquiry, this general buy-in becomes impossible to achieve. A safe, supportive, and reflective environment cannot fully exist in an inquiry group without trust between teachers and the establishment of norms of communication.

Weinbaum et al. (2004) argued that a lack of community leads to a defensive environment in which teachers operate in a protective vacuum; they guard their practice rather than collaboratively reflect upon it with an inquiry group. This protective mindset prevents a basis for inquiry. Without trust, the community cannot embrace the notion that student learning is a collective responsibility (Weinbaum et al., 2004). Teachers without a trusting community function within a system in which they act as the sole experts in their classrooms; they impart knowledge to their own students rather than

impact learning of all students collectively through open communication in a shared inquiry. This impediment manifests itself in resistance from experienced teachers, who believe that inquiry will be yet another of the many initiatives they have faced over their careers (Darling-Hammond & Richardson, 2009; Weinbaum et al., 2004). Deuel et al. (2009) argued that such resistance leads to teacher collaboration focused on proving students learned rather than on improving practices to ensure improved learning.

A final impediment to developing inquiry is the lack of necessary skills for successful implementation (Weinbaum et al., 2004). The first skill necessary to build inquiry is the ability to find or access relevant research related to an inquiry. A lack of understanding of how to build the norms of behavior and communication necessary to build a strong, trusting group, as well as lack of knowledge of procedures and protocols for examining student learning both can impede inquiry. Caine et al. (2010) stated that a healthy environment of open communication only exists when an inquiry group establishes a structured, but not restrictive, set of procedures and protocols. Without the knowledge of procedures and protocols, groups will likely not develop the open communication necessary for inquiry.

Reasons for Action Research

Action research is a means to collect data and implement change to improve student learning. Sela and Harel (2012) defined action research as teachers conducting research to investigate a problem within their classroom or school. Teachers gather information through data collection to achieve the goals of bringing about change to the school environment, improving student achievement, and reflecting on their teaching and student learning. Action research empowers teachers to investigate and build knowledge

within their own experiences instead of relying on the experience of outside researchers or other expert teachers (Brighton, 2009). Cochran-Smith and Lytle (2001) labeled teacher knowledge obtained from action research as targeted knowledge of each individual's teaching practice.

Historically, educational research has not had a great influence on educational practice (Riveros et al., 2011). Teachers learn from but do not value the outside research. Riveros et al. suggested several reasons for this failure. Teachers do not find outside research relevant or practical for their classrooms, or they find the research presented is not persuasive or even understandable to the classroom teacher. Therefore, even though outside research may be exciting and compelling, it simply does not impact teachers' practice or student achievement in the classroom. Action research, in contrast, tends to be more persuasive and relevant to teachers. Action research is meaningful to individual teachers because it is based on teachers own classrooms and within individual teacher's school environments.

Action research is practical research in which teachers choose their focus, their data collection strategies, and their analysis and interpretation of data (Sela & Harel, 2012). Teachers who engage in action research blend the domains of research and practice and view themselves as professionals rather than just knowledge sources for their students. A PLC's action research avoids contrived professional development experiences such as the 1-day workshops, motivational speakers, or isolated courses that ultimately have little direct impact on classroom practice and student learning (Danielson, 2006; Darling-Hammond & Richardson, 2009). Instead, teacher researchers find solutions to their own problems because they are their own experts. Teacher researchers

do not rely on outside experts to tell them how to address their students but rather carry out thoughtful reflection and research to determine what is best for their students (Sela & Harel, 2012). Teacher research embedded within a PLC is valuable because it supports professional behavior and professional development. Teacher research

1. Permits teachers to use new approaches in their classrooms
2. Benefits teachers who gain confidence in knowledge and practices within their classrooms
3. Is embedded in the work of the school
4. Benefits the educational system because it builds a continuing culture of change necessary for improvement
5. Benefits teaching practice because it builds the view of teachers as professionals (Sela & Harel, 2012).

Collaborative inquiry process. When teachers actively engage in work-embedded action research as part of a PLC, they become highly analytical and reflective about every aspect of their teaching and greatly impact student performance (Kuter, Altinay Gazi, & Altinay Aksal, 2012; Wei, Andree, & Darling-Hammond, 2009). According to Langer, Colton, and Goff (2003), teachers who engage in collaborative inquiry should follow a "ladder of influence" (p. 35). The process begins with reviewing student work and then moves upward to observing, organizing data, constructing meaning, making assumptions, drawing conclusions, and taking action. The Southern Maine Partnership, as well as other researchers, articulated a circular process of inquiry (Brighton, 2009). These researchers developed a cycle of inquiry a teacher enters at any point and returns to any step along the way if researchers perceive the need. The inquiry

process begins when teachers frame a question and brainstorm a protocol. The teachers then investigate relevant research and literature to develop a plan of action. At that point, the inquiry cycle moves from the collection of student data to the analysis of student learning. The inquiry process enables educators to envision how a PLC's mission, vision, values, and goals can advance their learning about their students. The circular inquiry process relies heavily upon teachers' ability to analyze student data and make modifications to their practice that impacts student learning (Brighton, 2009, Heritage, 2012).

As teachers bring student work to present to the PLC group, the data provided from the work and the groups' response to it take on critical importance (DuFour et al., 2008). Clarke (2012) asserted the critical role of data. Teachers use data from students and classroom experiences to bring about meaningful changes. Teachers recognized weakness or changes they needed to make to help bring about desired results, leading to tangible changes in their instructional practices (Sheridan, 2012).

Schmoker (2001) underscored the importance of how a collaborative group begins with data and uses that data to influence instructional practice and student learning. The inquiry group can then also overcome the great difficulty of designing high-quality corrective instruction. Guskey (1998, 2000) indicated that teachers have difficulty in developing ideas for corrective instruction if they believe they must do it alone. However, structured professional development cohorts with a focus on shared strategies, such as inquiry groups, can ease the difficult process of designing corrective instruction (Kuter et al., 2012). Teachers who share their successful approaches to similar student difficulties can provide tools for other teachers. Likewise, students who recognize a

similar approach from another class can utilize prior knowledge and experience to improve their own learning. Jenkins (2010) explained students benefit because they have a clear understanding of what their teachers expect of them and a clear understanding how to get to the desired outcome.

Teachers do not have to make tough decisions about how to improve student learning without the support of others. Therefore, individual teachers benefit from discussing recurring problems with other teachers to ensure they can create quality solutions about teaching and for learning. Because participants in the inquiry group share in decisions affecting all their students, they have a higher morale and sense of participation along with a commitment to the school's goal of attaining optimal success for all students (Kuter et al., 2012; Wei et al., 2009).

The entire collaborative inquiry process improves teachers' ability to reflect and grow as professionals. Teachers' professional growth is an organic process involving shared experiences that grow from socially constructed meaning (Kuter et al., 2012). Darling-Hammond and Richardson (2009) stated teachers need to emphasize active teaching, evaluate students, observe students, and then reflect upon each of these areas so they can develop questions, view multiple perspectives, examine their beliefs, and experiment with new pedagogy. Before teachers can change their practice, they must first develop a sense of unsettlement (Groundwater-Smith & Mockler, 2010). Once their experiences become unsettled, they can then examine their practice in order to improve upon it. The inquiry group allows teachers from different content areas, grade levels, and experiences to ask questions and offer suggestions based on their different perspectives as well as their assumptions about student work.

Teachers who engage in the process of collective inquiry can experience a heightened level of understanding of their own teaching (Brighton, 2009). The inquiry process, according to Langer et al. (2003), changes the way teachers think about student problems. Collaborative examination and analysis of student work alters the way teachers come to understand their students' problems. Then, the group works to identify corrective measures and share best practices to solve misunderstandings and raise student achievement (Wei et al., 2009).

Teachers and schools establish true professionalism when they engage in collaborative inquiry groups (Kuter et al., 2012). Teachers within an inquiry group experience a sense of professionalism not afforded in most school communities. Riveros et al. (2011) argued teachers gain significantly from inquiry groups. Riveros et al. explained teachers benefitted from becoming critical players in the school community because their involvement in an inquiry group transformed their classroom teaching. Teachers replaced a sense of isolation with a sense of professional and personal collaboration. Their newly acquired sense of professionalism allows these teachers to become owners of their practice and maintain leadership roles within the school to help students improve performance.(Kuter et al.).

Collaborative coaching and learning. The collaborative coaching and learning model combines teacher development and growth with the concept of increased teacher leadership to improve teacher practice, collegiality, and professionalism. Teachers who choose to participate in a collaborative coaching and learning model come together to share their ideas and pedagogical knowledge. Collaborative coaching allows teachers to choose to meet and break from the inherent culture of professional isolation (Darling-

Hammond & Richardson, 2009). Collaborative coaching and learning provides teachers the opportunity to model and experience the same learning and inquiry process they seek from their own students. Collaborative coaching also allows teachers to experiment and receive constructive feedback from a variety of colleagues.

When teachers engage in collaborative coaching, they are able to share with teachers from different content areas, grade levels, and experience levels. Dantonio (2001) characterized collaborative coaching as "collaborative, self-initiating and egalitarian" (p. 3). Collaborative coaching creates an egalitarian feel because as teachers openly develop themselves as professionals, they value all levels of teaching experience. Group members' shared values to improve their practice leads to teachers' growth and development. Teachers develop a shared trust that may not normally exist between teachers and administrators because unlike administrative evaluation, collaborative coaching focuses solely on the development of teaching skills, while administrative evaluation can also seek to identify deficiencies in skills and talents. Garmston (1987) began the discussion of collaborative coaching with the explanation that teachers and students grow through the analysis, interpretation, and application of teaching in relation to student learning. As teachers openly discuss what students learn and how their learning relates to what teachers want to achieve, real student and teacher growth can occur (Chappuis et al., 2009; Deuel et al., 2009; Wei et al., 2009).

The utilization of collaborative coaching and learning requires a fundamental shift toward teacher leadership and active involvement in professional development. The traditional approach to professional growth within a school moves away from an administrative mandate to one in which teachers determine what is valued (Wei et al.,

2009). Professional development decisions are unique to school and teacher (Darling-Hammond & Richardson, 2009). Teachers, not just administrators, should dictate what will be accomplished within the school in-service model based on perceived teacher and student needs (Brighton, 2009). In this way, teachers determine what is needed to create student improvement while maximizing their own strengths and improving their professional practice. This formula combines student needs and teacher talents to maximize benefit for all. Teachers engage together in self-study and inquiry about their practice as they complete their own research embedded in both their classrooms and their students' learning. Lambert (2003) labeled this level of self-analysis and metacognition as the highest level of leadership. According to Clarke (2012), the implications of an inquiry approach were teachers' heightened perceptions that their instruction was improving. Teachers also perceived a greater sense of belonging and happiness within their learning community (Neufeld & Roper, 2003a, 2003b). According to Dantonio (2001), as teachers gain comfort in seeking assistance and sharing difficulties, they further engage in inquiry into their own practice.

There is a clear relationship between teacher inquiry and PLCs (Brighton, 2009; DuFour et al., 2008). Because teachers choose to engage in a PLC and make student learning their focus, they develop a deeper understanding of their own students' learning needs as they evolve into stronger, well-rounded teachers (Darling-Hammond & Richardson, 2009; Lieberman & Miller, 2011). The collaborative coaching and learning within a PLC helps eliminate individual teachers rehearsing and performing their practice in isolation. When PLCs utilize teacher inquiry, school-wide reform and instructional renewal occur (Riveros et al., 2011). Riveros et al argued that when individual teachers

move beyond their own self-interest, they build strong research communities reflecting on quality teaching and learning. When teachers examine their teaching through inquiry in a PLC, they are able to take their practice to a new level. Educators involved in PLCs put teaching and learning first and reflect upon them to create excellence across a school (DuFour et al, 2008).

The Role of Teacher Leadership

For a PLC, building quality leadership means empowering all members to act for change. In this model, teachers within a school actively make leadership decisions without asking permission. Danielson (2006) believed that when teachers act upon a perceived need without administrative pressure, they demonstrate true teacher leadership. Because teachers make their own decisions, they can collaborate to ask difficult questions, use reflective practice, and analyze student data to create change and innovation.

Scholarship and research within the learning community can help build leadership capacity and a culture of learning. Schools in which collaborative leadership is the norm make action research a part of their inquiry stance. Lambert (2003) stated, "Action research became routine…questions and concerns were subjected to thoughtful dialogue and thoroughly investigated" (p. 9). Collaborative inquiry groups involved in action research focus participants on common questions. These questions allow teachers to reflect upon student work as well as outside scholarship to change and improve pedagogical practices and ensure student learning occurs. These actions signify the "highest level of teacher participation and skill" (p. 5) on Lambert's Leadership Capacity Matrix (p. 5). According to Clarke (2012), teacher research empowers teachers because

it allows them to share and listen. Every teacher benefits because irrelevant information is not forced on all teachers. Clarke described one teacher's analogy of a funnel. Teacher knowledge expands like a funnel turned upside, flowing freely. Opening up teacher learning creates limitless possibilities for all teachers. When teachers make informed decisions about pedagogy, all teachers and their students benefit. Teachers create a continuous cycle to examine student work, formulate questions, collect and analyze data, and reflect and take action.

It takes the combined efforts of all to construct and maintain a culture of learning in a school (Chappuis et al., 2009; Darling-Hammond & Richardson, 2009; Wei et al., 2009). For teachers, this culture begins with an authentic shared discussion and acceptance of the goals of learning, not just teaching (DuFour et al., 2008). Teachers must be open to seeking leadership, and administration must encourage an inquiry stance to engage in open discussions about student work and teacher pedagogy. As teachers engage in action research and collaborative inquiry groups, the focus on student learning becomes the focus of all staff, allowing a lasting culture of learning to evolve and grow. Each aspect of action research meaningfully connects to its other aspects. Because the aspects of action research are linked, each one influences the process and its outcome (Sela & Harel, 2012). As these components come together, a true PLC develops.

Protocols

PLCs use protocols to engage in inquiry. The use of the term *protocols* which, in this context, constrain participation in order to ultimately enhance participation, dates back to 1991, when a group of teachers from five high schools met to plan exit outcomes, the knowledge and skills necessary for graduation, for seniors (McDonald et al., 2007).

In order to ensure the quality of the discussion and outcomes, the participants at the meeting created a detailed process to structure conversations so that everyone had time to speak and listen. This process ensured participants could present information, examine information, and ask questions in a systematic fashion that allowed group members to establish the degree of trust necessary for open and honest feedback. The process evolved into the Tuning Protocol and has since developed as a process for teachers to examine student work and issues of practice. Other protocols have followed, but each contains some basic similarities (Allen & Blythe, 2004; Easton, 2009). All protocols incorporate specific steps to provide a structured conversation to advance discussions and answer questions about teaching and learning. They also designate specific participation roles: facilitator, presenter, and participants.

Protocols in education have evolved to define a particular type of group interaction in which educators utilize a set of specific steps in order to facilitate discussion, with the ultimate goal of addressing issues related to teaching and learning through in-depth inquiry (Allen & Blythe, 2004; Blythe, Allen, & Powell, 2008; Easton, 2009). Teachers use protocols to support learning about individual issues as well as sustain inquiry among a group of teachers. The extent to which a protocol determines a question or solves a problem defines its purpose.

Allen and Blythe (2004) contended that protocols help teachers determine a relevant problem or solve a problem. Some protocols can help teachers determine both a problem and its solution. Allen and Blythe described three features to protocols that, although necessary, account for variations among them. The first feature of a protocol is the amount of description and explanation of background information. Depending on the

protocol, the description of the context of the work can range from highly detailed to completely absent. The second feature of a protocol is how participants structure comments to describe what they see. Some protocols permit teachers to include strengths and any weaknesses they notice in the presented work or assignment. Other protocols require participants to withhold evaluative statements to help maintain trust within groups. The final feature of a protocol is the focusing question. Some protocols have a teacher-designed focus question the group helps answer, while others may have no question at all. Some protocols may even have a goal of helping teachers determine a relevant teaching or learning question as a consequence of the conversations that evolve out of the protocol.

A protocol's success is dependent on teacher disequilibrium resulting from several factors working in conjunction with one another (Allen & Blythe, 2004; Easton, 2009). The first factor creating the tension necessary for a protocol's success is the specific talking and listening tasks required of group members. Rather than allowing group members to speak at any moment, diverting the focus of the group, each member is required to listen and then speak at a designated time. This affects the second factor in creating tension, which is discipline of the group members. Even when permitted to speak, group members focus their observations or reactions around a specific type of commentary, such as descriptive commentary or commentary related to the strengths of the work they examine. The participants must withhold free commentary until they reach the protocol step permitting this free commentary. This control of participant responses also provides each member with a sense of safety. Group members come to know when

and how they may speak, but, more importantly, the protocol's predictability enhances the presenter's sense of security.

When a protocol controls specific types of commentary and focus questions, teacher presenters feel safe sharing their work and their practice. This creates opportunities for participants to delve into more sensitive issues within each teacher's practice or confront assumptions about individuals or groups of teachers. This environment impacts the final factor determining the success of a protocol: its influence on changing teaching practice and student learning. The systematic talking and listening steps help to produce a trusting, open discussion, allowing teachers to engage in a constructivist effort to address an individual teacher's problem, concern, or focus. At the same time, the other group members gain insights when they make powerful connections with their own teaching and students' learning (Allen & Blythe, 2004; Easton, 2009).

Effectiveness and Value

According to Allen and Blythe (2004), four factors influence the effectiveness of protocol conversations. The first factor contributing to the effectiveness of protocol conversations is the group participants' experiences. Group members' experience with using protocols as well as their trust of the other group members can affect the group members' degree of participation. If there is a lack of trust within the group, its members may be less willing to take risks within the group and may be more cautious when sharing with other teachers. Group members' willingness to engage in the learning of the group as well as their own learning can also influence the effectiveness of the protocol conversation. Easton (2009) suggested that the consistency of group membership can improve the PLC's willingness to engage in learning because all members are aware they

will eventually present and will not want to risk treating others in an unkind or unfair manner that they, too, could eventually experience.

The second factor that can influence a protocol conversation is the effectiveness of the presenter. The degree to which the presenters are able to share questions about their teaching practice or students, as well as the degree to which they can listen to and internalize feedback without getting defensive, can greatly impact the conversation. The next factor that can influence the conversation is the work a teacher presents. The quality or degree to which the work sample reflects student learning and is not the teacher's effort to impress colleagues in order to make a good impression can greatly influence discussions. If participants do not see the work's relevance to a worthy question, or if they perceive the work is an invalid reflection of student learning, then the protocol conversation will not be effective.

The final factor that can influence the effectiveness of a protocol conversation is the question or issue the group must examine. Questions presented to the group to answer are most effective at sparking quality conversations when the group members can readily relate the questions to their students and classes. Allen and Blythe (2004) contended that none of these factors alone can undermine the effectiveness of the protocol conversation. However, a compelling question or a highly motivated group can compensate for a weakness in another aspect of a protocol.

Protocols can have a significant impact on both individuals and groups (Allen & Blythe, 2004; Blythe et al., 2008; Easton, 2009; McDonald et al., 2007). Because protocols bring together resources, ideas, and strategies that may not be inherently available to each teacher, all group members can benefit. Blythe et al. (2008) used the

analogy of doctors consulting other doctors about unusual or complex issues and cases. When they seek the advice of others, participants can see critical data from others' perspectives, clarify their thinking, and construct a common understanding with colleagues. Together, group members can then learn to "apply them [these common expectations] to students' work" (Blythe et al., 2008, p. 5). In fact, groups can develop common standards and shared understanding of expectations of achievement of students.

Tuning Protocol and Collaborative Assessment Conference

The Tuning Protocol, developed by Joseph McDonald in 1992, and the Collaborative Assessment Conference (CAC), developed by Steve Seidel in 1988 (Blythe et al., 2008) are two well-established types of protocols that have been used extensively. Each protocol's purposeful design achieves a different purpose; therefore, each utilizes the features of the protocol differently. The purpose of the Tuning Protocol is to develop effective projects or assessments, develop teachers' common assessment standards, or align instruction with assessments. The purpose of the CAC is to learn about areas of student strength and weakness, gauge student interest levels, or reflect on ways to improve or revise instruction.

The Tuning Protocol and CAC incorporate the features of description, context, and selection of student work differently (Blythe et al., 2008) to achieve different purposes. In the Tuning Protocol, the participants provide both observational and evaluative feedback on student work samples, teacher assessments, or scoring rubrics. In CAC, on the other hand, participants' feedback focuses solely on student work. The participants describe the work, ponder issues they perceive, and pose questions about the work.

The context is also significantly different in the two protocols. In the Tuning Protocol, the presenting teacher opens with a description of the assignment and scoring, while in the CAC, the presenting teacher withholds a description until after participants have described the work and asked questions about the work. The student work selections can be very similar in both protocols. In the Tuning Protocol, teachers select from a variety of student work, such as written pieces or videos, and usually include a variety of student achievement levels. The CAC usually selects a work sample from an open-ended task which include a single student's work sample or multiple samples of a single student's work over time.

Student Understanding and Critical Thinking

Experts in the area of critical thinking generally agree that all students beyond the elementary school level can engage in critical thinking (Paul & Elder, 2007b; Willingham, 2008). However, students differ in the degree to which they can think critically. Not all students are reasonably expected to perform at the same level of proficiency in the same subjects or at the same rate as others. The development of critical thinking skills can manifest "in every modality of learning, student reading, writing, speaking and listening" (Paul & Elder, 2007b, p. 4). Therefore, it is the teacher's ultimate responsibility to engage students in learning that allows them to contextualize content within the competencies of critical thinking so they can develop deep understanding.

Wiggins and McTighe (2005) stated that students demonstrate mature understanding when they engage in six facets of understanding. When students truly understand, they "can explain, can interpret, can apply, have perspective, can empathize

and have self-knowledge" (Wiggins & McTighe, 2005, p. 84). Paul and Elder (2007a) went on to say that students understand and think critically when they demonstrate the "elements of thought" (p. 7) and can then apply "universal intellectual standards" (p. 7). Students who engage in these elements understand and think "for a purpose, within a point of view, based upon assumptions, leading to implications and consequences" (Paul & Elder, 2007a, p. 7). Students think critically when they use appropriate information to create and explain inferences to address a question. Paul and Elder also explained that students think critically when they can apply the intellectual standards' "clarity, accuracy, precision, relevance, depth, breadth, logic and fairness" (p. 9) to their thinking. Students apply intellectual standards to their thought when they develop intellectual traits, which include "intellectual integrity, autonomy, empathy, courage, and perseverance as well as confidence in reason and fair-mindedness" (Paul & Elder, 2007b, p. 51). These critical thinking behaviors are not readily apparent in student work artifacts but are more likely to appear in student reflections about their work (Grant, 2012).

Wiggins and McTighe (2005) explained what they called the instructional facets and provided instructional implications of these facets. Wiggins and McTighe stated that explanation requires students to explain the how and why of "events, actions and ideas" (p. 85). Students demonstrate understanding when they can take what appears to be an unrelated series of facts and independently connect them in a logical manner, as well as explain how and why these connections make sense (Heritage, 2008). To evaluate thinking, Paul and Elder (2007b) contended that students must be able to routinely use intellectual standards to ensure thinking is "clear, accurate, precise, relevant, deep, broad and fair" (p. 49). When developing instruction, teachers use active verbs such as

"support, justify, generalize, predict, verify, prove and substantiate" to develop student tasks (Paul & Elder, 2007b, p. 87).

The instructional implication for teachers is to design projects to address complex problems (Grant, 2012; Lattimer & Riordan, 2011) to ensure their students engage in critical thinking. Teachers want students to use their hands and minds to understand and support answers to complex problems instead of seeking a simplistic answer (Rotherham & Willingham, 2009). Paul and Elder (2007b) argued that teachers and students who think critically do not seek the one, correct answer but rather use data or text to develop, support, and justify an answer.

Hands-on projects designed to promote complex thinking provide students with instructional support for developing empathy. Empathy is intentional effort to "feel as others feel" (Paul & Elder, 2007b, p. 98) and "see as others see" (p. 98). Paul and Elder (2007b) described a student's accurate reconstruction of another's viewpoint as reasoning from "the premise, assumptions and ideas of someone other than their own" (p. 29). When students see value and meaning in what may be alien or uncomfortable they not only rethink their existing viewpoints, but they develop an openness that could lead to their change of heart on a well-entrenched view.

According to Wiggins and McTighe (2005), the third facet of understanding is interpretation. Students demonstrate understanding when they relate text or data to their own experiences. Hannafin et al. (2009) explained this understanding as the construction of knowledge students build as they associate their prior knowledge with the new knowledge and the goals of the task they are involved in. Students synthesize, analyze, organize, interpret, and explain the knowledge acquired from a variety of sources in order

to make it their own. This construction happens when they design original written, spoken, or artistic performances or build physical objects. Students who interpret construct meaning based on facts and experiences and make their assertions understandable and acceptable to others through their explanation. Instructional implications for interpretation include the design or development of original pieces using contradictory or disorganized sets of data.

The next two facets of understanding are application and perspective (Wiggins and McTighe, 2005). For over 50 years, application has been one significant form of understanding (Bloom, 1956). Students who engage in application take concrete knowledge and use it in novel situations or realistic scenarios without direct instruction. Frey, Schmidt, and Allen (2012) stated where application occurs, projects approximate real-world problems as closely as possible. Projects designed for content-specific disciplines mirror tasks that real experts in those fields would engage in outside of a classroom. Frey et. al found authentic achievement occurs when students apply the real skills of scientists, journalists, musicians, and historians to assess the mental complexity of problems these professionals actually solve. In an English classroom, Frey et. al explained application occurs when writers provide multiple examples, revise their work, and self-reflect upon their work. This means teachers must design authentic tasks for students to apply their knowledge.

Perspective is a mature understanding that there is often more than one reasonable answer or version of events. According to Wiggins and McTighe (2005), students demonstrate understanding of perspective when they recognize that a teacher or textbook is not the sole authority. Students exhibiting perspective can explain the extent to which

textbooks and teachers distort information in order to simplify it. Willingham (2008) argued even before fifth grade, students can demonstrate critical thinking when they provide sufficient factual evidence to support an assertion. The instructional implication of perspective for teachers is to provide students with many intentional opportunities to examine alternative perspectives. Rather than hope their students examine alternative perspectives through chance encounters, teachers provide the necessary resources to ensure that students examine perspective.

The final facet of Wiggins and McTighe's (2005) view of student understanding is student's self-knowledge. In this facet of understanding, students must make deliberate attempts to think about the way in which they see the world and question their thinking (Heritage, 2008). When individuals demonstrate self-knowledge, they are able to acknowledge the "uncertainty [and] blind spots" (Wiggins & McTighe, 2005, p. 102) that result from habits or preconceived beliefs. Self-knowledge allows the student to undo, question, and eventually reconfigure individual understanding in relation to others' understanding. This means teachers must provide planned opportunities for student reflection. Frey et al. (2011) stated that student self-reflection positively affects student achievement because it creates authenticity around the task. Heritage asserted that, as part of disciplined learning, students need to be taught to self-assess their performance as they gain knowledge of a discipline. Students should recognize whether they are gaining the knowledge and skills a person within the discipline deems necessary.

Burke (2009) stated formative assessment must factor into students' work in order to evaluate the effectiveness of student learning. Jenkins (2010) claimed students engage in interactions that allow them to have their work evaluated and offer ways to improve

whatever they are attending to in class. In this manner, teachers must give students the opportunity to identify the degree to which they understand the material they are learning and encourage them to think deeply about this learning.

According to Wiggins and McTighe (2005), teachers seeking to advance student understanding must keep in mind several overarching implications. The first implication for teachers is not to tell students what to know and understand. When, in an effort to save time, teachers dictate knowledge and understandings for students, students believe they should be passive fact memorizers who regurgitate these facts for a single test. Teachers must destroy this misunderstanding about student learning and help students understand that they will be expected to make meaning out of that which is problematic and complicated. To accomplish this, students must realize that they must uncover what lies beneath facts, and they must make meaning for themselves rather than relying on what a teacher says it means. In other words, they must become constructivist learners.

Wiggins and McTighe's (2005) second implication for teachers is to get students to embrace transference. Students must determine the most appropriate facts to use and decide under what circumstances they should use them. In other words, teachers' actions must force students to think about what information they use and the quality of the thinking that supports the information (Marzano, 2010). Students must realize that they must be independently capable of using knowledge and skills "creatively, flexibly, fluently, in different settings or problems" (Wiggins & McTighe, 2005, p. 40). However, cognitive psychologists generally agree, in order for students to build the schema necessary to perform complex tasks such as transference, teachers must first design more teacher guided work. (Hannafin et al., 2009; Willingham, 2008).

Backwards Design

Understanding by design (UbD) first emerged in 1998 when Wiggins and McTighe described it. Although updated in 2005, the foundation of UbD has changed very little. Wiggins and McTighe's premise is rather simple: Design instruction backwards to maximize desired results for students. To understand UbD is to understand the difference between students' knowing and students' understanding. There is a fundamental difference between memorizing facts for a test and understanding the meaning of those facts when they are combined with a broader realm of knowledge (Childre, Sands, & Pope, 2009; Heritage, 2008;). The goal of UbD is to answer this question: How do teachers design instruction to increase the likelihood that more students will understand rather than simply know?

To design understanding for students, teachers must first define and understand students' learning outcomes and then work backwards to plan accordingly (Heritage, 2008). To accomplish this, teachers must be able to clearly articulate what they want students to know and do as a result of their plan. Wiggins and McTighe (2005) called this a "results-focused design [rather than a] content-focused design" (p. 15). The content-focused design has been the more traditional approach for teachers. In this approach, teachers focus first on which materials they will use and what they will have students do, rather than first planning learning goals for their students (Childre et al., 2009; Graff, 2011).

The traditional approach to instruction leads to what Wiggins and McTighe (2005) called the "twin sins" (p. 16) of design. The first sin occurs when students have fun or do something that appears interesting but may or may not actually result in

understanding (Heritage, 2008). This error plays to students' egocentric thinking because so many believe students acquire knowledge without disciplined thought and intellectual energy (Foundation for Critical Thinking, 1999). The second sin of design occurs when teachers attempt to cover everything within a textbook without considering what understandings are truly essential (Childre et al., 2009). This form of design overburdens students and leaves them unlikely to think. Teacher and student dialogue does not exist because of the excessive quantity of content learning and assessments within the school year (Jenkins, 2010).

If teachers wish to ensure their students understand, they must not commit the twin sins. Rather, their students should be able to articulate the big idea of their learning, understand how ideas are interconnected and understand what their learning will enable them to do (Heritage, 2008). To assure students understand and do not commit the twin sins, teachers must determine acceptable evidence of student learning in relation to their stated goals (Childre et al., 2009; Graff, 2011).

When planning for UbD, teachers must follow a three-stage process, or template, for designing instruction (Heritage, 2008; Wiggins & McTighe, 2005). The first stage is to identify desired results. Teachers identify the relevant goals they want to address, typically using content standards and curriculum objectives. From these results, teachers design specific "enduring understandings" (Wiggins & McTighe, 2005, p. 342) that reflect big learning goals. These statements are the big ideas teachers want students to internalize long after the details of a class are lost. Graff (2011) stated that these are the ideas teachers want their students to know when they have forgotten everything else about the topic they have learned. In order to develop these understandings, students

seek to answer the "essential questions" (Wiggins & McTighe, 2005, p. 342), which are the broad, inquiry-based questions that guide both teacher and student (Larmer & Mergendoller, 2010). Elder and Paul (2009) stated it is important for teachers to get a clear understanding of what they want students to reason about, so their actions and examples can provide a clear logic for students to emulate.

Essential questions lead students not to one specific answer but rather to numerous plausible answers leading to critical thinking and understanding. Essential questions "establish learning goals or determine learning means" (Hannafin et al., 2009, p. 768). These questions require reasoning and have more than one answer. In such questions, the teacher asks students to seek the best answer along a continuum of possibilities (Larmer & Mergendoller, 2010; Paul & Elder, 2006c). Student answers can then be evaluated for reasonableness based on "universal intellectual standards [such as] clarity, accuracy, and relevance" (Paul & Elder, 2006a, p. 9) as well as "breadth, depth, logicalness" (Paul & Elder, 2006c, p. 322). Wiggins and McTighe (2005) explained Step 1 of UbD as a way to state what key knowledge students will know and what they should be able to do as a result of the design.

During Stage 2 of UbD, teachers determine acceptable evidence of student performance (Childre et al., 2009; Larmer & Mergendoller, 2010; Wiggins & McTighe, 2005). In this step, teachers consider five factors to ensure the assessments provide "fair, valid, reliable, and sufficient measures of the desired results" (Wiggins & McTighe, 2005, p. 28). The first factor teachers must consider is whether students exhibit understanding through authentic performance tasks. The second factor teachers must consider is whether they have criterion-based scoring tools to properly judge student

achievement. For the next two factors, teachers devise various methods to assess learning and use those as methods for feedback as well as evaluation of understanding. For the final factor, teachers ensure that students have opportunities to self-assess and reflect on their learning. These opportunities give students the chance to self-reflect on whether they meet the intellectual standards of clarity, accuracy, relevance, logic, breadth, precision, significance, completeness, fairness, and depth, as well as the intellectual traits that include intellectual humility, autonomy, integrity, courage, perseverance, empathy, and confidence in reason (Paul & Elder, 2007a).

In Stage 3 of UbD, teachers must consider to what extent their plan is "effective and engaging" (Wiggins & McTighe, 2005, p. 28). In this step, the teacher states the activities and lessons in the plan using Wiggins and McTighe's (2005) acronym WHERETO. The first component of WHERETO helps students know where and what is expected of them. In this step, teachers also determine what students already know, typically referred to as prior knowledge. Childre et al. (2009) and Elder and Paul (2009) explained the importance of students connecting the new knowledge teachers consider important to their own experiences in order to make their learning real and meaningful.

In the next components of WHERETO teachers create activities that hook and hold student interest and equip them to explore the big issues. The R of WHERETO requires the teacher to provide students with opportunities to rethink and revise understanding as they work so they can then evaluate their own work. Teachers develop assessments requiring elements of specific critical thinking standards as well as a plan for how students will use these skills, anticipating obstacles students will encounter so teachers can successfully get students to assess their own reasoning (Heritage, 2008;

Willingham, 2008). This leads to the T in WHERETO, during which teachers tailor or personalize learning experiences based on the needs of their students. This requires teachers to understand their students' needs and scaffold learning experiences that meet the needs of a variety of learners (Childre et al., 2009). The final element of WHERETO requires teachers to organize in a manner that maximizes effective learning for all and minimizes lost or wasted time.

Project-Based Learning—Theory and Practice

Teachers typically want to engage in a constructivist teaching methodology. That is to say, teachers want students to take responsibility for their own learning, become autonomous learners, develop integrated understandings, and ask and answer important questions (Brooks & Brooks, 1999; Larmer & Mergendoller, 2010; Rotherham & Willingham, 2009). Instead, teachers often lament over how quickly students forget what was covered just a day or so before. In actuality, students have not forgotten; they never actually learned. When teachers seek to cover such vast curricular content, they try to expose students to everything that could be on a test, rather than allow them to learn the concepts and skills necessary to understand the most important concepts. The result is a recurring problem in which students understand only a tiny fraction of knowledge from entire units of study (Wolk, 2008). For teachers, the question then becomes, how does one move from coverage to learning? One answer is to follow a constructivist approach through PBL.

Since its advent in 1992 (Markham, Larmer, & Ravitz, 2002), the PBL practice has expanded from medical schools to secondary and even to elementary levels. Five

criteria help define and explain PBL. Larmer and Mergendoller (2010), along with Grant (2012), provided some excellent descriptions of PBL:

1. Projects are central to the curriculum.
2. Projects revolve around a central driving question or ill-defined problem.
3. Students construct knowledge as they answer the problem.
4. Projects imitate real-life experiences.
5. Students work on projects collaboratively.

The first criterion of a PBL project is its central role in curriculum. As students engage in the project, they actually learn the key elements of curriculum. Lattimer and Riordan (2011) noted that while many projects seem to fit the definition of a PBL project, those that reteach central themes through examples previously taught are not true examples of PBL. Additionally, extracurricular or enrichment activities also do not fall under PBL because they are not central to the curriculum and not all students engage in the learning activity. When they engage in a true PBL project, students learn the important concepts of the curriculum simultaneously.

The second criterion of PBL is the driving question that pushes students to struggle through subject-matter inquiry because of the broad nature of the question (Larmer & Mergendoller, 2010). The depth and breadth of the question should require students to engage in the higher order thinking skills of "analysis, synthesis, and inquiry" (McGrath, 2002–2003, p. 37). Yet, McGrath (2002–2003) warned, students must acquire the necessary skills, research, technology, or content prior to engaging in the project. According to Barron et al. (1998), the point of the question is "to make a connection between activities and the underlying knowledge that one might hope to foster" (p. 274).

If the skills are not in place to achieve the knowledge, students who are expected to learn from the entire project could fail because they grow frustrated with the process and are not driven to "ask questions, learn more, or feel the need to learn something they do not already know" (McGrath, 2002–2003, p. 37). A PBL question should engage students in inquiry behaviors with which they may initially struggle, but those behaviors should ultimately drive them to learn the curriculum.

The struggle to learn provides the basis for the third criterion. In this criterion, students construct their own meaning as they solve the project. Thomas (2000) stated students construct knowledge when they complete a variety of products. As students complete products, they first identify and solve a problem. Students then must design and develop their own product that demonstrates how they solved the problem. Students struggle to combine the discovery of the problem, the answer to the problem, and the method they will use to present the solution to the problem. Larmer and Mergendoller (2010) asserted that giving students a choice is critical in helping give the project meaning. Regardless of the type of project, its focus must allow students to construct knowledge instead of simply apply previously learned knowledge.

The fourth and fifth criteria of PBL projects give students the feel of a real-life experience (Larmer & Mergendoller, 2010). The projects are designed to give students an authentic problem-solving experience and allow them to work independently rather than under the traditional teacher's guided seatwork. This means students can potentially implement their solution or project. As a result students feel a real-life connection to the project and do not view it in isolation.

PBL differs from typical class activities because students perceive the typical class activity as something to be done for a class, for a teacher, or for a grade rather than for an experience relevant outside of school. This means the activity that produces a known result is not PBL; such non-examples would be predesigned lab activities or instructional booklets or simulations. Rather, PBL should encompass multiple disciplines and require students to construct skills and knowledge from several content areas. Since this type of project is much more reality based, it is more authentic. Outside of school, individuals rarely engage in problems strictly based in a single discipline. Additionally, teams or groups of individuals outside of school work collaboratively to complete a task. This is also true of PBL. Because students actively work without constant supervision of the teacher, they have a great deal of autonomy over the project. While the guiding question central to the curriculum defines student activities, individual groups of students develop the subsequent questions, resulting in a variation of student inquiry and eventual construction of student knowledge (Thomas, 2000).

Project-Based Learning—Effects on Students

Studies have consistently found PBL significantly impacted students (Curtis, 2002; David, 2008; Gultekin, 2005; Larmer & Mergendoller, 2010). An examination of PBL indicates that student growth is most apparent in their motivation and work habits. Other significant areas of student growth include problem solving and higher order thinking, and even student achievement on standardized tests.

PBL can especially influence students' motivation. Researchers of PBL found that student motivation improved during PBL (Gultekin, 2005; Larmer & Mergendoller, 2010). Students and teachers indicated that students actively engaged in learning as

opposed to sitting passively as teachers utilized traditional teaching methods such as large group lecture and note taking (Gultekin, 2005; Larmer & Mergendoller, 2010). Students engaged in PBL found learning to be meaningful, which led to further inquiry (Gultekin, 2005; Larmer & Mergendoller, 2010). Curtis (2002) found that PBL motivated students to learn. Students' actions serve as evidence to support such a statement. Students engaged in PBL were less likely to become discipline issues and had increased attendance levels (Curtis, 2002). Additionally, Curtis (2002) reported that students engaged in PBL were more likely to go beyond minimum expectations. Students' work on their projects motivated them to raise their own level of performance because of their heightened interest, which resulted from the realistic nature of their work and the natural tendency of the project to support student inquiry (Curtis, 2002).

Lattimer and Riordan (2011) agreed that students engaged in PBL were more motivated. Lattimer and Riordan studied students ranging from sixth to eighth grade. Students showed great pride in the products they created during PBL. Students reported an increased interest in the topics under study and were more likely to engage in sustained inquiry based on their heightened motivation levels (Lattimer & Riordan, 2011). Barron et al. (1998) and Penuel, Golan, Means, and Korbak (2000) showed that increased student engagement led students to take greater responsibility for their own learning. Barron et al. found that before their experience with PBL, students were not likely to engage in revision of their work. Yet, when engaged in PBL, their teachers reported students were more likely to revise their work. Additionally, students were more likely to view school favorably and continue to improve and work hard based on their own perceptions of their work, even a year after completing their PBL experience.

Barron et al. also reported that students felt a sense of pride and accomplishment in their work even a year after its completion.

Well established research supports students' overall improved academic success when engaged in PBL (Boaler, 1997, 2002; David, 2008; Ergul et al., 2011; Gultekin, 2005; Shepherd, 1998). In Boaler's (1997, 2002) and Shepherd's (1998) studies, PBL contributed to student gains in subject-matter understanding and problem-solving abilities. Boaler (2002) found that PBL math students outperformed students taught in a traditional teacher-led math classroom when answering procedural questions, conceptual questions, questions requiring recall of a rule of formula, and complex questions requiring applications of multiple rules in combination. Students in the PBL study performed as well or better on questions requiring rote memorization. Of greatest significance is the number of PBL students who achieved the highest rating on the examination. Boaler (2002) found that PBL students were 3 times as likely to reach the maximum score as their traditionally instructed peers. This indicates the growth of students' higher order thinking skills as compared to the limited growth in this area when teachers utilized traditional instructional methods. Similarly, Shepherd reported that PBL students self-reported increased confidence and learning. Test results confirmed the students' feelings. Students who completed a 9-week problem-based project showed significant improvement on the Cornell Critical Thinking Test (Cognition and Technology Group at Vanderbilt University, 1992). Significantly, Shepherd, the Cognition and Technology Group at Vanderbilt University, and Penuel et al. (2000) demonstrated that even limited PBL experiences significantly improve students' problem

solving, critical thinking skills, and attitudes toward learning without limiting their content knowledge acquisition.

Specific studies of various groups of students also suggest higher achievement and learning after completing PBL (Ergul et al., 2011; Penuel et al., 2000; Royal, 2007). Ergul et al. (2011) investigated PBL effects on science students. Ergul et al. investigated science students in two groups: Grades 4–6 and Grades 7–8. The findings indicated a significant difference in the PBL study group compared to the traditionally taught control groups. The PBL students outperformed the traditionally taught students in science process skills, which Ergul et al. defined as transferable skills actual scientists use, which teachers identified to help students learn content of the physical sciences, ensuring active student participation. Students also maintained responsibility for their own learning to replicate the behaviors of a scientist operating in a real-world setting. In Ergul et al., both PBL and traditionally taught groups received pre- and post-tests to determine growth in science process skills. The results of the pretest showed no statistically significant difference in skills between groups in both grade levels, but both post-tests showed a statistically significant difference for both grade groups. PBL students outperformed the traditionally taught students. In fact, the traditionally taught seventh- and eighth- grade students showed a decline in average overall performance from pretest to posttest (Ergul et al.).

PBL also positively impacts students' perceptions of learning and perceptions of specific school subjects (Ergul et al., 2011; Grant, 2012; Lattimer & Riordan, 2011). Ergul et al. (2011) specifically examined the perceptions of students with and without PBL experiences. Using a pre- and posttest evaluation, Ergul et al. found that both PBL

and traditionally taught seventh- and eighth-grade students reflected more positive attitudes about science, but the PBL group showed a statistically significant positive attitude from pre- to posttest, while the traditionally taught group reflected no significant attitude change from pre- to posttest. The fourth- to sixth-grade students reflected very different results. The PBL students also showed a statistically significant, more positive attitude toward science from pre- to posttest. However, the traditionally taught fourth- to sixth-grade students reflected a real decline in positive attitudes toward science from pre- to posttest.

Problem Solving and Higher Order Thinking Skills

Student growth in problem solving and critical thinking is another well-established indicator of PBL success (Curtis, 2002; Ergul et al., 2011; Gultekin, 2005; Lattimer & Riordan, 2011). Curtis (2002) found that students' growth in critical thinking was apparent in their ability to retain information and appropriately apply it to solve the problem when engaged in a problem-solving project. Lattimer and Riordan (2011) reported significant areas of student growth in a PBL middle school. The students demonstrated habits of mind and work typical of individuals in academic and professional disciplines. Students developed solutions to projects that addressed unstructured, real-world problems. Student solutions required the same competencies necessary in real-world collaborative work groups. The students extended their work outside the classroom into real field work and community explorations. The students also presented their projects in exhibitions to outside evaluators against real-world standards of performance. The exhibitions also created connections with mentors and established a community of learners from a greater field of study.

Project-Based Learning—Implications for Teachers

Content knowledge acquisition is particularly important because critics of the PBL pedagogy have long argued that the unstructured nature of PBL results in limited student knowledge and, subsequently, lower standardized test scores (Tretten & Zachariou, 1997). Some of the strongest critics of PBL are teachers. While researchers suggest teachers see great value and improvement in students' attitudes, work habits, and critical thinking because of PBL, few teachers actively engage students in PBL (Willingham, 2008). After focusing his study on student perceptions, Grant (2012) uncovered several implications for PBL teachers. Grant offered teachers five specific considerations when designing project-based instruction. The first consideration for teachers is time. Grant suggested that teachers seriously consider the appropriate project duration for their student population, and that they vary the length of projects they design throughout the year. The second consideration for teachers is the teacher-as-coach role. Grant found that students relied heavily on their teachers to guide their learning, so both teacher and students seemed to revert to more traditional, didactic roles. Instead of allowing students to identify resources independently, teachers provided extensive resources and students limited their exploration and use of resources to the ones the teacher provided; they also used them only in the classroom. Grant suggested that teachers put a much greater emphasis on determining and adapting their role as coach during a project to assure student independence. A third consideration for teachers involved students reverting backwards. Grant found that students relied heavily on prior knowledge and experience to guide their actions and decisions. Grant recommended that teachers design explicit parameters so students understand what teachers expect versus

what is open to their discretion. Grant also suggested that teachers set explicit expectations regarding the transference of knowledge and skills from other disciplines since students inherently seemed to isolate their subject-matter knowledge and skill into a single context. As a result, students were not readily using the potential strengths they may have had to improve the quality of their projects.

Two final considerations Grant (2012) offered teachers designing PBL projects related to understanding student perceptions before projects and student learning during projects. Grant suggested teachers understand and offer guidance around student perceptions of projects. Grant found that students tended to perceive projects as less academic than tests. Because students tended to view projects as less difficult, they also took actions that resulted in products reflecting limited depth and breadth. Their expectation of a grade, rather than the learning they could achieve, dictated their actions. These actions, Grant suggested, compel teachers to provide students with explicit expectations for PBL to enhance their understanding. Finally, Grant compelled teachers to utilize student reflection to gain a better understanding of their students' developmental processes. Grant suggested student artifacts do not contain sufficient evidence of students' understandings. Therefore, Grant advised teachers to embed student reflections throughout the learning process in order to understand student scaffolding needs.

Teachers should also not understate the importance of scaffolding. David (2008) suggested teacher-designed scaffolding readily embedded into the learning process could overcome student concerns and fears about PBL. Scaffolding presented just in time, prior to a perceived student need, has deeper value to students (Baron et al, 1998; Childre

et al., 2009). When students feel an immediate need for new knowledge or skills, they gain enduring learning that they value more deeply. Grant (2012) even suggested that teachers design scaffolding for potential future use. Consequently, teachers anticipate what students might need but may never actually end up using the designed scaffolding pieces. If teachers design projects without appropriate plans for scaffolding to support the higher order thinking processes essential for open-ended PBL, their students, especially those with special needs, may become frustrated and fail to engage. Opportunistic scaffolding helps build the metacognitive processes that provide students the time to think and then to act productively to complete their projects.

Methodological Insights

Researcher's dissatisfaction with the constricting nature of quantitative research contributed to the first qualitative research in Chicago during the 1920s (Hatch, 2002; Rodriguez, Schwartz, Lahman, & Geist, 2011). Researchers embracing qualitative approaches to research identify a clear distinction between qualitative and quantitative research. In essence, there is a stark difference in how qualitative and quantitative researchers interpret reality (Nicholls, 2009). Researchers embracing qualitative research approaches take an interpretive view as they seek to explain or understand a particular group or experience (Rodriguez et al., 2011). At the heart of qualitative research is a desire to develop an understanding of what a phenomenon means to people or how they make sense of their experiences (Lincoln & Cannella, 2004). Qualitative researchers reject the traditional quantitative approaches because those approaches fail to describe the social experience and are ill suited for the complexities of a social society. Qualitative

researchers also reject the quantitative approach because of the heavy reliance on the observable (Carpenter & Suto, 2008; Rodriguez et al., 2011).

Case study is a common form of qualitative research that provides a focused investigation of a specific group or phenomenon. Merriam and Associates (2002) and Hatch (2002) stated that case studies are special kinds of research because they investigate a specific phenomenon within clearly defined boundaries. Boundaries help researchers focus their attention to "specify the unit of analysis" (Hatch, 2002, p. 30). Patton (1990) stated that researchers know what they will be able to speak about at the conclusion of the study because they have clearly identified a unit for analysis. Creswell (2013) stated that case studies require "in-depth data collection involving multiple sources of information rich in content" (p. 61). Therefore, researchers engaging in case study rely on a wide range of data. These data can include interviews, transcripts, notes, journals, as well as other specific evidence gathered as examples from the group under investigation (Bassey, 2002).

A group interview or a focus group is one form of data collection particularly effective in case study (Litosseliti, 2003; Rodriguez et al., 2011). Typically, a moderator or someone else in the research group conducts the interview. In order to be effective, this person must direct the conversation so it remains on track. Usually, the interviewer has a predetermined protocol of focus questions that reflect broad themes the group will address (Rubin & Rubin, 2012). It is necessary for interviewers to be knowledgeable of the research and adept at investigating more deeply through probing questions so they can acquire specific information from group members to adequately support the themes they are investigating (Litosseliti, 2003; Rodriguez et al., 2011; Rubin & Rubin, 2012).

The advantage of a focus group is that it allows the researcher to explore in-depth topics in a safe environment with a group (Krueger, 1994). Focus groups give researchers the ability to find out what participants think or have learned about something after an educational approach has been applied to the study setting (Nicholls, 2009; Rodriguez et al., 2011).

When educational researchers analyze data for qualitative studies, they typically seek to determine the emergence of themes. They use individual pieces of data to determine patterns (Potter, 1996). Hatch (2002) explained the process as pulling together individual data pieces to develop into a cohesive whole. Qualitative researchers often triangulate their data to help determine the themes and support these themes' quality. While triangulating their data, they use other data pieces to verify the quality of their findings (Creswell, 2013; Hatch, 2002; Yin, 2009). Triangulation helps qualitative researchers attain generalizability (Creswell, 2003; Merriam & Associates, 2002). Generalizability entails the degree to which findings could apply to other, similar situations. Eisner (1991) stated that generalizability allows researchers to create a rich image that other teachers could use as an original example to educate teachers or evaluate teaching. The method used to ensure the transference in this study was rich, thick description. Merriam and Associates (2002) stated that rich, thick description provides readers with adequate detail so they can determine to what degree the situations in the study are transferable to their own.

Summary

This literature review described how a constructivist approach to teacher learning is inherent in a PLC's shared learning and inquiry. The literature emphasized that when

PLCs routinely incorporate teacher inquiry, teacher research, and collaborative coaching, teachers better understand their practice, which can lead to improved instruction and student learning When teachers in a PLC utilize protocols such as the Tuning Protocol and CAC, they enable themselves to help foster quality instructional design and understanding of student learning. PLCs utilizing protocols can use these tools and an instructional design framework, such as backwards design, to build a PBL model focused on toward students' critical thinking (DuFour et al., 2008; Easton, 2009; Ergul et al., 2011; Wiggins & McTighe, 2005). It is easy to envision teachers utilizing protocols in a PLC to help construct PBL exercises that could then generate pieces of student work. This student work could then be brought back to the PLC to again utilize a protocol to develop teacher understanding of students' critical thinking. Section 3 provides a description of the methodology of this study.

Section 3: Methodology

Introduction

The purpose of this qualitative case study was to explore the influence of a PLC, using a protocol, on teachers' perceptions of (a) the instructional design for critical thinking and (b) students' critical thinking. Creswell (2013) stated that case studies need an "in-depth data collection involving multiple sources of information rich in content" (p. 61). The complexity of gathering data for two aspects of teacher perceptions, as well as the number of teachers involved as both presenters and participants at PLC meetings, suggested the need to collect data from a wide variety of sources. Through his definition, Creswell suggested that a qualitative case study was the best approach to gather the qualitative data necessary for this study, since it required the dual examination of teachers' perceptions about critical thinking in instructional design and their understanding of students' critical thinking. Merriam and Associates (2002) and Hatch (2002) stated that case studies are special kinds of research that investigate a specific phenomenon within clearly defined boundaries. These boundaries target the researchers' focus because they can "specify the unit of analysis" (Hatch, 2002, p. 30). When researchers clearly define the unit of analysis, Patton (1990) stated, they know what it is they will be able to speak about at the conclusion of the study. In this case study, the units of analysis were the teacher perceptions of both instructional design for critical thinking and students' critical thinking.

There is little evidence in the literature discussing how a PLC, using an inquiry protocol, influences teachers' perceptions of instructional design that targets critical

thinking skills and teachers' perceptions of students' critical thinking (Crosby, 2007; DuFour et al., 2008; Easton-Watkins, 2005; Lieberman & Miller, 2011; Newmann & Wehlage, 1995; Riveros et al., 2012; Scott, 2012; Sparks, 2005; Vescio et al., 2008; Weinbaum et al., 2004). This case study's design allowed an investigation of teachers' perceptions of a protocol structure's influence on a PLC with a targeted goal. In this case, the "units of analysis" (Hatch, 2002, p. 31) were teachers' perceptions of instructional design for critical thinking and students' critical thinking. A case study made it possible to use the constructivist nature of the PLC group's discussions to understand teachers' perceptions more precisely. As the PLC followed a protocol to guide its discussions, I was able to capture teachers' perceptions using data from audiotaped sessions of PLC meetings, teachers' field notes from PLC meetings, and an audiotaped group interview with PLC members reflecting their individual and shared understanding of projects and student work. Using a single qualitative case study to generalize teachers' perceptions made it possible to develop an understanding about their perceptions of critical thinking both in instructional design and in student learning that could resonate with a larger audience beyond the school involved in the study.

Research Questions

Two research questions guided this study:

1. What influence do inquiry protocols, used in professional learning communities, have on teacher perceptions of instructional design for critical thinking?
2. How does the use of inquiry protocols in professional learning communities influence teacher perceptions of students' critical thinking?

Constructivist Qualitative Tradition

The qualitative tradition of this research study reflects the constructivist model. The constructivist believes individuals develop reality within the specific constructs of their own perceived reality or vantage points, which can be experience-based (Guba & Lincoln, 1994). As a result, when individuals interact together, their understanding of the world in which they engage is "in fact, what we agree it is" (Hatch, 1985, p. 161). Stake (1995) referred to qualitative studies as "experiential understanding" (p. 37), in which researchers seek to understand "the complex interrelationships among all that exist" (p. 37). Mishler (1986) stated because the researcher and participants within a study co-construct knowledge and understanding of the phenomenon under investigation together, the researcher should not be distant and objective. In fact, through the relationship with the study and its participants, the researcher is able to gain a mutually agreed-upon understanding of the subjective reality under investigation.

Within the constructivist tradition, the researcher presents data in the context of a case study so the researcher can provide a rich narrative (Hatch, 2002). Hatch further stated that when a researcher presents rich detail and representation of participants within a case study, readers can see themselves within the participants to some degree and can therefore make sound judgments about the study's findings. Stake (1998) stated the constructivist view supports an emphasis on descriptions the reader "ordinarily pay[s] attention to... not only commonplace description but thick description" (p. 102). Stake also explained that researchers' complete a case study based on the idea that in education, the cases of interest are usually the people or programs within it. Since each case is unique yet similar to others in numerous ways, teachers are interested to see how their

experiences compare to the experiences of others. They come to recognize how they are similar and dissimilar as they learn from the stories that surround each study.

Other forms of qualitative research were not appropriate for this study. Grounded theory and ethnography do not provide the appropriate analytical basis or goals for the research questions and setting of this study (Merriam and Associates, 2002). Merriam and Associates stated phenomenological research focuses upon important everyday experiences. The phenomenological researcher uses psychological or common everyday experiences in order to capture insight into phenomenon of these areas. While the deductive analysis common in phenomenological research and the use of interviews as a primary data collection piece are appropriate for this study, this study's research questions have no practical relevance in determining the phenomenon of an experience. Hatch (2002) further stated that studies based within the constructivist tradition are not suited to qualitative traditions other than case study.

The qualitative case study approach was preferable to a quantitative approach for this study. This qualitative case study approach allowed teachers in the PLC to share their perceptions as they occurred through a natural setting. This was preferential to a quantitative study because, as Creswell (2003) stated, quantitative studies have predetermined criteria that influence the outcome of the study. The problem was not to identify factors that influenced teachers but, rather, to determine teachers' perceptions. Teacher perceptions were not clear before the study began. Teacher perceptions formed and evolved through each participant's observation and articulation. If the study utilized predetermined variables, these variables would not have provided the desired evidence of

depth of teacher understanding. As a result, a quantitative study could not have achieved the desired understanding.

Context of the Study

This study occurred in a suburban school district located in the Northeast. This small district is comprised of four schools; two schools service elementary grades, and one common shared campus services both middle and high school students. The district is less than 10% minority, and its per-pupil spending far exceeds the state average. Ninety-eight percent of high school graduates go on to postsecondary education (New York State Education Department, 2011). Community involvement and expectations are very high in the district. The study took place in the middle school, which services students in Grades 6–8. The school population consists of 451 students, 45 full-time teachers, and 2 full-time administrators.

Ethical Protection of Participants

The research group was in existence prior to the year of the study. The group evolved in numbers and members over the three prior years of its existence. Group members recruited other staff members to join as members left the PLC after the first or second year of the group's existence. Group members joined and left the PLC based upon their interest and left based upon their decision. Few ethical concerns regarding recruitment and collection of materials existed. Inclusion into the PLC was voluntary and presenting teachers selected the materials they presented to the PLC. No student names appeared in the data collection or presentations. I removed all students' names prior to copying materials for presentations to maintain anonymity of all student work. In the

event a teacher did not remove names, I removed them before copying materials for the group. Group members received no type of incentive for participation.

After obtaining IRB approval (07-28-10-0345192), I sought consent from all participants as well as building and district administrators. The district administration as well as the building administrator approved the study before the study commenced. Each participant received a letter of consent (Appendix A), and each participant provided a signed copy before the collection of data began. At the outset of the research study, I informed all participants that they could withdraw at any time without any adverse consequence. Because all participants volunteered, issues relating to non-participation were not present. However, participants did attend PLC meetings according to their availability. At times, teachers' professional obligations to their students took precedent over attending meetings. The PLC's size and composition accommodated participant absences. When participants were absent from presentations, sufficient PLC participants attended to provide complete feedback for presenting teachers. One PLC participant did leave before the end of the study because of a medical leave from the district. Just as this case study included sufficient participants to function when group member's schedules conflicted with presentations, a group member leaving the PLC did not negatively affect the data collection or the PLC.

I assured all participants that no data collected would be shared or used for any purpose without their consent. Because I do not act in an administrative position, participants were assured that no information discussed in the PLC would be shared or used in an evaluative manner nor provided to administration for such purposes.

Additionally, participants received all collected data for their verification before the completion of the study.

To ensure all participants' safety and confidentiality (American Psychological Association, 2009, p. 231,240), I adhered to several ethical considerations. I created a numerical code for participants instead of using their names. Additionally, I worked to ensure that participants experienced no unreasonable demands on their time or work as a result of their participation in the study. To avoid such adverse conditions, participants presented work that came directly from the classes they taught. Additionally, participants attended PLC meetings during routine school hours. I stored all data collected from the participants on a password secured USB drive in locked metal file storage. After 5 years, as is the norm for research, I will destroy the data (American Psychological Association, 2009).

Role of the Researcher

I am a full-time teacher at the study school. In the past, I acted as a grade-level team leader for the eighth grade. This position did not include any supervisory duties; it included responsibilities that related solely to organizing and supervising whole-class activities for students. Because of these roles, I established a professional relationship with the study participants that helped me to recruit members for the study. I generally have the respect of colleagues and have a reputation as a highly involved, hard-working colleague who has high expectations for the entire school community. This helped me to recruit teachers to join the PLC as members came and went. Because I was involved in the PLC since its formation, I acted as a facilitator for the group throughout its existence. In this role, I provided relevant reading resources for group members, organized and

arranged the group's meeting dates, and acted as facilitator when the group began using a protocol to guide its activities. My role within the group helped my relationship with the research participants. I developed a comfortable working relationship that extended beyond collegial interactions among teachers. A comfortable working relationship enabled the study to achieve "the hallmarks of high-quality qualitative work" (Hatch, 2002, p. 8). The constructivist design of the study, discussed previously, supported the researcher's level of involvement in order to fulfill the goal of a case study.

Because I was completing the study in what Glesne and Peshkin (1992) called backyard research, I was required to be open and honest about any potential hindrances to data reporting. I did not have any supervisory relationship with any of the participants that could potentially alter the outcomes of the data. Additionally, triangulation, member checks, and rich, thick description of the findings created the necessary trust and credibility for the study. Yet, I faced potential bias. First, I had to be open to members' negative reactions to the PLC, which occurred when members did not participate in presentations because of other obligations. I had to set aside any personal feelings about absences and accept that group members had professional obligations as well as obligations to students, parents, family, and administrators. A second bias I had to be aware of was to avoid potential errors or confusion when interpreting participants' comments or judgments around critical thinking. As facilitator of the group, I had to allow any participant to comment freely without attempting to correct or influence such comments. Because I allowed the participants to comment freely, the group could use such comments to help construct its knowledge.

Criteria for Research Population

The research population consisted of 11 teachers who all voluntarily came together to join a PLC in the middle school. Group members' common interest in critical thinking was the motivation for their work together. This common interest provided the necessary motivation to meet outside of the regular school day on a semi-regular basis. The group members' years of teaching experience ranged from 6 to 18 years. Group members taught different grade levels, sixth through eighth grade. Participants did not all share common students or subjects. Teachers involved in the study taught in four different core subjects—English, science, social studies, and math—and included special education teachers, a health teacher, a technology teacher, and a music teacher. All of the participants had completed their master's degrees at the time of the study. Merriam and Associates (2002) stated "purposeful sampling" (p.12) was necessary because it provided the most appropriate level of learning. The size of the PLC group provided a purposeful sample.

The variety of teaching experience, content area specialization, and student populations provided the information-rich cases necessary for in-depth study. The size of the group allowed for the practical limitations members encountered as part of their school day. Some members were unable to participate from one meeting to the next, so in order to allow presenting teachers to receive appropriate feedback, it was necessary to have an adequate number of teachers at presentations. Additionally, the 11 teachers provided a broader range of experience, subject areas, and grade levels necessary to ensure an appropriate degree of transference was possible since, "information-rich cases are those from which one can learn a great deal about issues of central importance to the

purpose of the research" (Patton, 1990, p. 169). The variation of participants' experience and teaching assignments will allow a variety of teachers to relate to the study. Therefore, many different types of teachers can relate their experiences to the experiences of teachers in the study and apply this study to their own practice and experience with critical thinking.

Participant Field Notes

PLC participants' field notes were the first pieces of collected data. Teachers submitted their field notes after each PLC presentation. Merriam and Associates (2002) contended that "research-generated documents often contain insights and clues into the phenomenon, and most researchers find them well worth the effort to examine" (p. 13). According to the protocol the group followed, each participant completed field notes based on the protocol (Appendix B). In their field notes, participants aimed to incorporate feedback relating to the 25 critical thinking standards the PLC used (Appendix C). The critical thinking standards (Appendix D) incorporated Paul and Elder's (2007a) work on critical thinking. Appendix D reflects the starter stems PLC participants developed through their discussions in order to help develop a common understanding of each standard. The stems included both "sounds like" and "looks like" interpretations to help PLC participants complete field notes as they listened to presentations. Participants used the starter stems to provide feedback about the most appropriate standards reflected in a teacher's presentation. Within the field notes, teachers offered warm feedback, which could include observations and interpretations of evidence of the critical thinking standards in a presented project or student work example. Participants also offered cool feedback, which included potential critical thinking

standards that could improve or were missing. Cool feedback could include suggestions on how to alter the instructional design or how it might appear in a student's work. Feedback could reflect specified critical thinking standards the presenting teacher identified as relevant, as well as other critical thinking standards participants felt were relevant to the presentation.

Audiotaping

A second form of collected data was the audiotaped PLC sessions. Merriam and Associates (2002) called this form of data observation data. This form of data is a "firsthand encounter with the phenomenon" (Merriam & Associates, 2002, p. 13). Merriam and Associates stated that when collecting observational data, the researcher could function as an active participant or even as a "very active participant observer...who is a member of the group...while observing" (p. 13). As the PLC engaged in sessions that followed the protocol process for both instructional design as well as student work evaluation, I audiotaped each session. This process allowed me to gather data from the participants' conversations, rather than only from their notes. I was able to act as facilitator of the protocol process and still record participant and presenter responses in addition to the other documents they generated.

Group Interview

The final format of collected data was a group interview completed at the conclusion of the study. By the time the group interview occurred, all participants had engaged in multiple sessions designed for both instructional design and evaluation of student work. The interview questions, as listed in section 4, were open-ended questions designed to elicit participants' free responses about their perceptions of critical thinking

in instructional design and perceptions of students' critical thinking as a result of their engagement in the PLC protocol process. Merriam and Associates (2002) stated researchers collect and analyze data concurrently. When researchers simultaneously collect and analyze data, they are able make adaptations and evaluate early themes as they emerge (Merriam and Associates).

I used ongoing data analysis after collecting field notes and transcribing the audiotape of each PLC meeting. Ongoing analysis helped determine emerging themes that helped me finalize interview questions to probe those emerging themes further. The interview contained what Hatch (2002) described as formal and informal aspects. The formal aspect of the interview included predetermined questions provided to the participants. The informal aspect was the follow-up questions that helped clarify participants' thoughts about emerging themes that had evolved out of ongoing analysis field notes and transcripts of PLC sessions. Merriam and Associates (2002) stated that simultaneous data collection and analysis are advisable because to postpone analysis until the end of the study can lead to confused, unfocused stacks of data that give the researcher no real direction in which to begin the analysis.

Data Analysis

For the purpose of this study, I conducted inductive analysis of data using documents, audiotapes of PLC sessions, and a group interview. The analysis began as soon as participants completed and submitted documents from PLC sessions and I transcribed audiotapes. I gathered documents and audiotapes of the PLC meetings and conducted the group interview over the fall of 2010. The exact dates of the PLC meetings were dependent on participants scheduling meetings to present student work or

projects using the Tuning Protocol design discussed in Section 2. Hatch (2002) described data analysis as a process to search for the meaning of data in order to explain it to others. Researchers analyze data to help identify and then explain connections that potentially exist within the various data pieces. Researchers then seek to explain the conclusions they drew about the relationships the data suggested. Hatch contended that in most qualitative studies, the quality of the analysis improves if analysis begins early. This early analysis allowed me to immediately identify deviant cases and probe them, as well as develop themes for the group interview through targeted questions.

The qualitative method of analysis was an inductive analysis. Hatch (2002) described inductive analysis as thinking that moves from the specific to the general. "Understandings are generated by starting with specific elements and finding connections among them. To argue inductively is to begin with particular pieces of evidence, then pull them together into a meaningful whole" (Hatch, 2002, p. 161). Potter (1996) further stated that researchers use individual aspects of data to see patterns the specific pieces of data support. The inductive analysis followed the general process Hatch described:

1. Read data and identify frames of analysis.
2. Create domains based upon relationships discovered within frames of analysis.
3. Identify salient domains, assign them codes, put aside others.
4. Reread data to refine domains.
5. Determine if domains are supported by data—search for data examples that run counter to relationships found in domains.
6. Complete an analysis within domains.

7. Search for themes across domains.
8. Select data excerpts to support elements of themes. (p. 152)

I completed this process as participants submitted documents from the PLC meetings and after completing a transcription of the audiotapes. As themes began to emerge, they became focus questions for the group, and then I completed another inductive analysis with the transcription of the group interview. To properly develop coding, I read the data, set them aside, reread them later, and then reread them again one last time. Each time, I identified salient pieces of information. After the third read, domains emerged to address the research questions. Hatch (2002) stated that no matter what form of analysis they use, researchers must read and reread to ensure the data support the existence of emerging domains. Rubin and Rubin (2012) stated rereading allows the researcher to check for consistent and accurate information and then modify the emerging themes to match the data. By reading and coding data multiple times, researchers can examine the data for themes and note any discrepant cases.

External Validity/Generalizability

Qualitative researchers tend to discuss external validity in terms of generalizability (Creswell, 2003; Merriam & Associates, 2002). Generalizability entails the degree to which findings of a qualitative study can apply to other, similar situations. Eisner (1991) argued that "for qualitative research, this means that the creation of an image—a vivid portrait of excellent teaching, for example—can become a prototype that can be used in the education of teachers or for the appraisal of teaching" (p. 199). In this study, rich, thick description ensured transference. Merriam and Associates (2002) contended that this level of description allows readers enough detail to determine to what

degree their individual situations match the study and to what degree the study's findings are transferable to their individual situations. Firestone (1993) referred to this as case transfer, and Walker (1980) believed transfer occurs when readers can use the detailed description to determine whether findings are relevant to their individual situations. This study provides enough description and information so readers can judge to what degree each individual's experiences are similar to theirs and, consequently, to what degree these findings apply to their own individual experiences (Merriam & Associates, 2002). Another strategy utilized to enhance transference in this study was to maximize the variation of the sample. This study can potentially apply to a broader range of readers because it examined a wide variety of teachers' work experience, student populations, and subject matter. Merriam and Associates argued that a wide variety of participants allows readers to appropriately apply the results to a greater range of situations.

Internal Validity

In qualitative research, internal validity is often associated with trust, authenticity, or credibility (Creswell & Miller, 2000). According to Merriam and Associates (2002), a qualitative study is especially valuable because it determines whether researchers are actually observing what they think they are observing. Because qualitative researchers take on the primary responsibilities of data collection, analysis, and interpretation, they are closer to the reality they are researching. Because of the researcher's role, Merriam and Associates claimed that qualitative research has inherent internal validity. To strengthen internal validity, researchers can utilize numerous strategies to help validate a qualitative study (Creswell, 2003; Merriam & Associates, 2002). Triangulation was one strategy utilized in this study.

I developed focus questions through a triangulation process. As I analyzed PLC transcripts using the previously stated inductive analysis process, themes began to emerge. I triangulated these early findings to help develop focus questions. Triangulation entailed comparing presentation transcripts with teacher field notes to confirm emerging themes. I developed focus questions to allow participants to elaborate on the emerging themes that helped address the research questions. Rubin and Rubin (2012) stated it is important that focus questions allow the participants to state what is important to them. I waited to develop focus questions based upon participants' presentations and field notes, which allowed me to include what was important to study participants. Rubin and Rubin further stated focus questions should use terms and concepts that participants understand. For this study, the PLC group used a particular protocol and critical thinking standards that were unique to their experiences. As a result, I also completed member checks as focus questions were developed. I also informally questioned participants so that I could apply their unique experience and knowledge to the development of credible focus questions.

The interview process gains validity when the participants involved have first-hand knowledge of the research or the research problem (Rubin & Rubin, 2012). Rubin and Rubin further stated this first-hand knowledge would allow interviewees to use the precise language of the focus questions to describe experiences that best help address the research questions. One of the study participants withdrew from the PLC before the group interview. The participant left the school on a leave of absence, but did present a project to the group and acted as a participant for other projects before the leave of

absence. The participant's withdrawal from the study allowed me to conduct a cognitive interview as an opportunity to validate the interview questions further.

Cognitive interviews allow the researcher to evaluate how an interviewee understands, processes, and responds to particular questions so that the researcher can recognize any potential breakdown in the process of asking and answering questions (Willis, 2004). Willis stated researchers use cognitive interviews to test both written and orally presented questions. Willis further stated that because cognitive interviews have great flexibility, researchers could apply them to their particular circumstances. Researchers complete cognitive interviews between the drafting of the questions and the actual interview. Researchers complete the cognitive interview with someone having the unique perspective of the focus of study. The study participant who withdrew was the only person who shared the other study participants' unique perspective. The cognitive interview ensured focus questions would provide participants the opportunity to elaborate on emerging themes as they pertained to the research questions.

I interviewed all possible interview candidates in the final group interview. The study participants were the only ones with the unique knowledge and understanding of the PLC, the protocol and the critical thinking standards that were central to the research questions. Because I included all participants and their divergent views, the study gains further validity (Rubin & Rubin, 2012).

A second common strategy used to ensure internal validity is member checks (Creswell, 2003; Merriam & Associates, 2002). The researcher conducts member checks to confirm that the final report, as well as transcripts, is accurate. Merriam and Associates (2002) even stated that "tentative findings" (p. 26) should be taken back to

participants to see if they agree that the researcher's findings "ring true" (p. 26). This study incorporated routine member checks to verify the accuracy of transcripts and the findings that developed.

Summary

I employed a qualitative case study to provide the vivid description needed to explore the influence that protocol use within a PLC had on teachers' perceptions of instructional design for critical thinking and teachers' understanding of students' critical thinking. The detailed description of the case study, the variety of participants, and the three types of data collected allowed readers to judge the transference of how a PLC using a protocol can influence teacher's instructional design of critical thinking projects and teacher understanding of students' critical thinking. For this study, the researcher followed an inductive analysis to develop emerging themes. Section 4 describes the findings, based on analysis of the collected data.

Section 4: Results

Introduction

The purpose of this qualitative case study was to explore teacher's experiences using inquiry protocols to determine teachers' perceptions of (a) instructional design for critical thinking and (b) students' critical thinking. To help understand 11 teachers' perceptions, I analyzed three pieces of data. The results of the study indicated two divergent perceptions. Some teachers' perceptions indicated strong or emerging clarity about instructional design for critical thinking and about students' critical thinking. On the other hand, some teachers' perceptions indicated confusion about instructional design for critical thinking and about students' critical thinking.

Overview

The school district under study had a strategic plan calling for the development of PLCs to advance teaching and learning issues within the district. The school district community expressed a desire to advance students' critical thinking, but there was no expressly stated way to use PLCs to address the community's concerns about critical thinking. The PLC that became the basis for this case study came together in 2008–2009 because of teachers' common interest in critical thinking. Not all teachers who started the PLC took part in the study because some members left the group after the first school year of its existence, but the PLC recruited new members based on interest. PLC membership remained unchanged from the 2009–2010 school year through the 2010–2011 school year. In order to help them better understand and discuss Paul and Elder's (2007b) critical thinking standards, PLC members devised a series of stem statements (Appendix D) in 2009-2010, prior to the collection of data for this study. These critical

thinking standards and the PLC's stem statements were critical components of the protocol process used during PLC meetings and therefore were integral in understanding group members' discussions, commentary, and field notes during the study.

The PLC participants were motivated to meet outside of the regular school day because of their common interest in advancing teacher-developed critical thinking instruction and understanding of students' critical thinking. PLC participants had between 5 and 17 years of teaching experience. All participants had completed their master's degrees at the time of the study. They taught grades 6–8. Not all participants shared common students or subjects. At least one participant represented each of the four core subjects areas: English, science, social studies, and math. There were two special education teachers, a health teacher, a technology teacher, and a music teacher. Table 1 identifies each teacher's identification code, as well as subject area, and years of experience.

Table 1

Participant Data

Teacher code	Subject area	Years of experience
P1	Social studies	6
P2	Social studies	17
P3	English language arts	13
P4	Math	10
P5	Math	8
P6	Science	8
P7	Health	14
P8	Special education	8
P9	Special education	5
P10	Music	6
P11	Technology	13

Five participants presented to the PLC group. P2 and P3 presented student work for evaluation and P4, P6, and P7 presented projects. All presenting teachers sent a meeting request to all participants. Meetings were scheduled prior to the regular school day; and attendance depended on participants' availability. Prior to presenting to the group, presenting teachers identified specific critical thinking standards for group members. The identification of specific critical thinking standards allowed participants to target their attention and comments toward those standards; however, it was also common practice for the group to comment on other appropriate standards during presentations. The protocol field notes (Appendix D) for each participant include the identified standards.

I recorded and then transcribed all PLC meetings to begin early analysis. Group members received transcriptions for member checks. I read the participants' field notes and transcriptions for emerging themes. Hatch (2002) contended that in most qualitative studies, the quality of analysis improves if it is begun early. This early analysis allowed me to identify and probe deviant cases and information as well as develop targeted questions around themes for the group interview. After my initial data analysis, the PLC group then participated in a final group interview, which I audiotaped, transcribed, and provided to participants for member checks. I read, reread and coded the interview to determine emerging themes.

Research Questions

The following research questions were the focus of the data collection:

1. What influence do inquiry protocols, used in PLC's, have on teacher of instructional design for critical thinking?

2. How does the use of inquiry protocols in PLC's influence teacher perceptions of students' critical thinking?

PLC Interview Questions

1. Can you describe how comfortable you are in identifying critical thinking in project design?
2. How has the protocol process in PLC meetings influenced your design of instruction?
3. Can you describe how comfortable you are in identifying critical thinking in student work?
4. How has the protocol process in PLC meetings influenced your understanding of critical thinking in student work?
5. Can you describe any perceived relationship between the PLC critical thinking protocol process and your instructional design?
6. Can you describe any perceived relationship between the PLC critical thinking protocol process and actual or potential student's critical thinking performance?

Findings

The critical thinking PLC's group interview provided greater insight into the influence an inquiry protocol used in a PLC has on teacher perceptions of instructional design for critical thinking and teacher perceptions of students' critical thinking. Data analysis indicated an emergence of four broad themes. Teachers tended to perceive instructional design for critical thinking in two contrasting fashions. Teachers tended to

exhibit clarity regarding instructional design for critical thinking or confusion regarding instructional design for critical thinking. Similarly, two themes emerged around teacher perceptions of students' critical thinking. Some teachers reflected clarity regarding students' critical thinking, while others reflected confusion. Table 2 identifies themes and subthemes.

Table 2

Themes

Theme	Subtheme
Confusion in instructional design	• Inability to understand and apply critical thinking standards • Accidental application of critical thinking • Ownership
Clarity in instructional design	• Different subject-area preference • Student work builds project clarity • Inspiration for yearlong design goals • Specific pedagogical recommendations for enhancing critical thinking standards
Confusion around students' critical thinking	• General identification • Gradations
Clarity around students' critical thinking	• Specific identification of critical thinking in student work • Specific identification of critical thinking tied to specific suggestions for advancement of critical thinking • Student parroting • Student identification

Confusion in Project Design

I designed the first two interview questions to elicit answers to the first research question about teacher perceptions of how the PLC protocols influenced instruction

designed to include critical thinking. Teacher perceptions developed as members examined and discussed a presenting teacher's project. Group members used a protocol to focus their attention on specific critical thinking standards. A theme that emerged from the first two interview questions and answered the first research question was teachers' confusion regarding instructional design for critical thinking. Several group members expressed general confusion when asked to understand and apply critical thinking standards into instructional design. In one subtheme of design confusion, teachers had a general sense of confusion about what the critical thinking standards meant, which resulted in their desire for greater simplicity. In a related subtheme, teacher confusion about critical thinking design was evident when they accidentally included standards of critical thinking. Teacher confusion was also evident in their descriptions of developing projects. Teachers developed their focus from prior understanding and then accidentally discovered they had incorporated a critical thinking standard into their project design. A final subtheme that contributed to design confusion was the lack of ownership some teachers felt regarding the critical thinking standards and the PLC protocol process. Some teachers felt the process and the standards actually inhibited their ability to design and use the PLC to enhance critical thinking. Some teachers demonstrated a lack of ownership of the PLC protocol process when they described how obstacles such as a lack of comfort presenting to a group impeded their design of projects. Still other teachers demonstrated a lack of ownership when they explained that there was insufficient time in their curricular schedules. Teachers felt this time impediment prevented them from incorporating critical thinking standards into instructional design.

Inability to understand and apply critical thinking standards. One subtheme that emerged was some teachers' perception that the standards were too difficult to understand and apply to projects. Some teachers felt it was difficult to understand critical thinking through the standards because they found the standards to be overwhelming and even repetitive. Therefore, teachers sought to have the standards simplified into a version they could more easily understand.

P7 described how understanding critical thinking standards was too difficult. As a result, P7 was unable to incorporate standards into project design or find it in others' projects. This teacher, like several others, sought a simpler system of standards and described the PLC's 25 standards inaccurately by overstating the number of standards that existed:

> I found identifying it in my own things or identifying other people's things was difficult if I was being asked to take that enormous document and apply it to a work piece. It was too big. There were some of them that I understood and some that went past me. I just didn't get it. They didn't, or I don't know if they didn't apply to what I was doing, I just didn't understand them. I didn't understand what their purpose was....I would have preferred to have three things—three very broad critical thinking standards that would apply unilaterally, no matter what the subject area, because having whatever it was, 30, after the first four, I was lost. (P7)

In a follow-up statement, another group member stated that many of the standards seemed to overlap. This overlap made P7 feel like "[I}was reading the same thing." Participant 10 reiterated this point of confusion by stating,

> Sometimes I don't know which one to use because, to me, some standards say the same thing, yet I know they are different because they all say different things, but sometimes I can't figure out which one is saying what I want.

This same teacher went on to speak about how the standards used in the PLC protocol process were a source of confusion:

> [The standards] made critical thinking more confusing to me....I realize what I thought was critical thinking is not what we have decided is critical thinking. I'm not exactly sure the standards are helping me find critical thinking. Some of them I understand and some of them, and those are the ones I choose to use in a project, and the others that I don't understand I just kind of ignore.

P1 also felt the critical thinking standards seemed a bit overwhelming. P7 spoke of the desire to simplify them because there were too many to refer to during project design:

> I wouldn't mind if they were categorized, so if there are 25, if five subtopics and each fit into five, that would make it easier for me....But to keep the 25 or so of them in my head or pull them up when I wanted them was never something I was able to do. I can't handle 20-something at a time. If there were a way to narrow them down to help me. Whenever I have them next to me, I feel like I can use them. Some I like better than others. I don't feel like any were incomprehensible, just hard to put them all into the brain at one time.

These teachers' statements indicated that they could not understand all of the critical thinking standards the PLC group used. Teachers who did not understand the standards and could not remember the standards were not likely to use the standards as reference

items during project design. The fact that some teachers wanted to reduce the number of standards suggested that they were not particularly familiar with the critical thinking standards and therefore could not see their value as reference tools. In several instances, these teachers indicated that if there were fewer standards, they would be better able to recall them. P10's comments about what critical thinking was suggested the desire to make things as simple as possible without having to use the standards. Other participants' responses indicated that they were reluctant to use the standards because they did not know as much about critical thinking as they had first perceived. They did not wish to view critical thinking as complex and not easily understood. Teacher comments suggested that because of their confusion, teachers did not incorporate critical thinking standards into projects where they could have incorporated them. If teachers had included such standards, they may have designed and had their students' complete projects that had great potential to engage critical thinking skills. However, because they omitted standards, students would complete projects that would not push their critical thinking to its greatest potential.

Accidental application. Another subtheme that emerged was teachers' accidental inclusion of critical thinking in projects. Several teachers spoke of a desire to utilize their previous PBL understanding rather than utilize the critical thinking standards. Two teachers went so far as to say the inclusion of critical thinking in project design was almost an accident and they realized its existence only after they had designed the project. P10 explained,

> I think it's because I feel more comfortable with project-based learning and I understand that better. So I don't know that I'm choosing critical thinking as a

> result of us getting together or me seeing people with it, but it's something maybe that I think about; it's not something I have consciously decided, "Okay, so for this project I'm going to try to do this one critical thinking standard."

P1 agreed and furthered the sentiment, stating,

> I think because I learned project-based learning first, I got more comfortable with that. I still go back to that and find myself with that in my head, thinking about project-based learning, which are similar to the critical thinking standards. But, it's more like I use the project-based learning structure when I'm planning, but then if I look at the critical thinking standards, I say, "Oh wow, look! I hit this and this standard when I wasn't thinking I was going to hit them at all."

P5 also felt the same, stating,

> I definitely agree. When I'm planning projects, I use the project-based learning first, and then if I happen to hit a critical thinking standard, I'm stoked. But I think the critical thinking pieces are ingrained in the project-based learning. There's definitely at least one of the 152 standards that are on the list will be in the project.

These perceptions suggest that critical thinking was not the primary planning point for teachers. It is noteworthy that they designed instruction based on prior understanding instead of the new critical thinking standards, and they seemed to incorporate the standards after the design was complete. This further supports the notion that some teachers' reluctance to use the critical thinking standards to help them design projects may have contributed to their confusion.

Ownership. A third subtheme contributing to teacher confusion in instructional design for critical thinking entailed their commitment to the time involved in developing students' critical thinking as well their ownership of the PLC protocol process's value in helping them develop projects. Some teachers felt the PLC protocol process did not support their understanding and inhibited them from building an understanding of critical thinking in their project design. Some teachers' perspectives suggested these factors influenced them because of their lack of comfort surrounding presentations of projects. P1 felt that using Paul and Elder's critical thinking standards was less effective in helping to build an understanding of critical thinking than if the group had, as part of its protocol process, developed its own standards of critical thinking:

> I feel like the critical thinking standards came from these experts and they weren't something we kind of talked about and said, "I think this is a standard and this isn't a standard." I think they were given to us to work with, and that was helpful. [But] if we were to come up with our own critical thinking standards, we would do it differently and then we would have more ownership of those standards and would be more comfortable using them.

P1 expressed a dislike for outside experts and indicated a desire for the PLC to design its own standards of critical thinking instead of using use an outside expert's version. This indicates that some teachers in the group did not value outside knowledge as much as others did, which could explain why some teachers would not utilize the critical thinking standards as a resource for project design. Likewise, this perception could help explain why some teachers were not as vested in the PLC protocol process.

P10 stated the protocol process in the PLC did not particularly help develop an understanding of critical thinking in general or in P10's own work, despite efforts to actively participate in the entire process:

> As we talked more and more about critical thinking, I didn't feel I was understanding it any better by spending more time with it, and I don't know why that is. And I still try, I came, I read through the stuff, and commented on people's work, and I tried to do so in my practice, but for whatever reason, I found it hard. It's not catching on, I don't feel like it's catching. Maybe it is and I don't recognize it in my own teaching.

Unlike some teachers in the PLC, P10 seemed to demonstrate the perception that even when engaged in the group, the PLC did not alter instructional practice. P10 did not indicate, as others did, a sense of inspiration that could carry forward into project design.

P7 expressed that the inability to present finished projects caused discomfort with the protocol process. P7's position as a non-core subject area teacher also contributed to a feeling of apprehension: "I never felt comfortable....It felt like this was a place you only brought finished or near finished stuff, as opposed to being a nonacademic core teacher bringing something new in." P3 attributed apprehension to a personal lack of comfort:

> I felt it was more me feeling scared to do it. It wasn't like I wasn't encouraged to do it. I don't know what all the answers are, so I'm not comfortable bringing it to the group when I don't know what my goal is.

P11 echoed this apprehension as well as a concern about presenting to the group as a nonacademic teacher: "I was very intimidated by the 'Now present a project that you're doing' because I thought I'm not confident enough that in my subject area at that level

that's what I was hoping to get from it." P7 expressed a contrasting view when attributing difficulties not to personal fears but to the PLC's protocol process:

> For me, it's not a matter of insecurity. I didn't have a problem sitting with a group member and not being correct or having someone say, "That's not right"; that's not my trepidation. The protocol [is what] made it difficult for me.

These teachers' comments indicates their discomfort because of their lack of understanding, their reluctance to let their colleagues see this lack of understanding, and their fear of appearing to fail in front of their colleagues. Even though one teacher commented about feeling encouraged to present, there was a fear to do so. This may suggest that the PLC protocol process should incorporate a spiraling mechanism to support those who are less comfortable as well as a means to ascertain group members' comfort and understanding of the group's focus around a particular standard or set of standards.

Another factor contributing to lack of ownership involved the notion of time. Participants said a lack of time constricted their ability to design around critical thinking; some even felt that it was not worth the time necessary to design their classes around critical thinking. Other participants suggested it was easier to design for critical thinking for some subject areas rather than others because time was less of a factor.

P3 questioned whether the complexities of designing and implementing critical thinking activities with students were realistic. P3 questioned whether students would be able to complete all the tasks and thinking necessary for a project. P3 explained it as follows:

> It comes down to time. Do you have the time to realistically do that with them? "Let's look at this idea and where it came from." I think it's better to do it with their own work: "This is what I'm going for," and give them a model to ask themselves, "To what degree did mine get there?" and then look at each other's. I wonder if that would be more beneficial to start?

P3's statement suggests a lack of backwards design planning and execution of learning activities to improve performance in multiple critical thinking standards. Rather, P3 appeared to suggest that after students complete a piece of work, they could use a pre-developed exemplar and then evaluate their success compared to the exemplar. P3's comment suggests that this teacher asks students to judge themselves on a standard of success that the teacher did not articulate as part of their evaluation simply because it will save time.

In contrast, P4 said it was possible to design extensively for critical thinking because the class had the necessary time needed for such work:

> Students discussed specific standards and were asked to develop what they might look like and sound like, and with a lot of prompting they got some very global responses. Ultimately, I will want them to go back to them [the standards] to develop more specific responses. Rather than saying, "Intellectual perseverance is to continue thinking when I reached a struggling point," say, "I went and grabbed an algebra textbook and researched nonlinear equations because I know...." So a lot of it is structured, because that is a luxury I have in a math lab class.

P5 indicated a particularly pointed view that lack of time was a factor for critical thinking in a specific class:

> I don't think I would be able to do critical thinking with the consistency [that Participant 4's or 10's] classes would where I could bring critical thinking into the curriculum and build a project around it, and then 2 weeks later do another project, and so on.

When asked a follow-up question about whether it would be possible to create a yearlong focus around a broad curricular connection to a single standard, P5 suggested the time needed to establish this connection was extensive:

> If my goal for the year was to develop a single critical thinking standard, I feel I would have to familiarize students with this. First, I'd have to develop the rubric with the end result, and I'm not sure what that end result would be with a critical thinking standard. I would have to develop the rubric and feel comfortable with it to be able to model the rubric and how it would work in that process, and then give students enough opportunities throughout the year, giving the specific goals in mind, which would be difficult to find. It would definitely be very time consuming in getting kids to use the rubric and a process of thinking and move them along in that process.

These two teachers' comments indicated a significant contrast in the perception of time and how it influenced their ability to design for critical thinking. In the first instance, a strong sense of ownership of the entire PLC process was apparent when P4 described having students utilize a similar protocol design process that the PLC engaged in and described how the curriculum addressed a specific standard in a very general way. P4

felt there was ample time to ensure students developed precise answers and actions that demonstrated the critical thinking P4 sought for them, whereas P5 provided many reasons why the time involved was too great to achieve what another teacher perceived was possible. This may suggest that some teachers in the PLC were not as vested in the application of critical thinking in projects as other group members were, and when presented with an obstacle such as lack of time, used it as a justification to exclude critical thinking from their project design.

Clarity in Project Design

Another theme that emerged around the first two interview questions was teachers' clarity regarding instructional design for critical thinking. Teachers reflecting this theme tended to demonstrate a growing confidence in recognizing the elements of a project that would induce specific critical thinking standards. Teachers identified different subthemes that influenced clarity.

The first subtheme influencing clarity was the ease of identifying critical thinking design elements in particular subject areas. The second subtheme influencing clarity was the inclusion of student work with project presentations. These two subthemes influenced teachers' growing clarity in their ability to identify critical thinking design elements within a project. Teacher perceptions relating to clarity in instructional design also indicated the PLC's role in helping teachers to identify specific critical thinking goals that influenced their instructional design throughout the year. In this subtheme, teachers stated that other teachers' presentations inspired them, leading them to create yearlong goals around specific critical thinking standards. These predetermined goals helped guide projects and lessons throughout the year. Design clarity was also evident in

participants' PLC presentations. In a final subtheme, participants' feedback helped the presenting teachers improve the quality of instructional design for specific critical thinking standards. During PLC presentations, teachers offered the presenting teachers targeted, specific pedagogical suggestions to improve or enhance their projects. This section describes each of these subthemes in detail.

Different subject-area preference. Subject-area preference emerged as one subtheme. Some teachers felt that certain subject-area presentations influenced their ability to identify critical thinking elements. One teacher spoke of his ability to see the critical thinking design elements in other subject areas he did not teach. He felt he had limited experiences because non-core subject area teachers of non-core subject areas rarely presented projects or student work in the PLC setting. He seemed to indicate that because core content area teachers presented more often, he had grown comfortable seeing critical thinking in their work, but he found it difficult to recognize critical thinking in his own project design. P10 stated,

> I see it better when it is not my own work...because it is so infrequent that there are special-area teachers sharing and being involved in groups like these, so I am used to other people's work and trying to make it fit into what I do, too. So I can see, that is why I think it is easier for me to see in other people's work, because I am not used to doing it in my own.

Some teachers agreed that it was getting easier to identify evidence of critical thinking they saw in other content-area projects. However, other teachers noted that projects designed for other subject areas also led to an improvement in their ability to design for critical thinking elements within their own subject areas. P4 stated, "The

identifying in other teachers' design is becoming easier or I'm more comfortable with it," to which Participant 3 added, "As I go through and see [evidence of critical thinking] in other people's work and presentations, I find myself starting to put things together...so seeing other people's work and disciplines helps me figure out how to better do that."

One teacher saw little connection between presentations from other subject areas and her own increasing clarity around critical thinking design. This teacher felt that it was very difficult to identify the elements of design that invoked critical thinking outside of her subject area. Her response indicated a lack of confidence outside of her subject area of mathematics. In this instance, P5 stated that teachers could only improve their own design clarity around critical thinking when viewing presentations within their own content areas:

> For whatever reason, I will be able to pinpoint a critical thinking piece if [P4] were to present a math project as opposed to a social studies project. I feel like I am more in tune with, I understand where this is going and how it is planned. I get what he is trying to get out of the kids, where in a social studies project I may not be able to understand or predict what is wanted from it.

When P5 asserted understanding a math teacher's critical thinking goal but could not easily identify a similar critical thinking goal in a social studies teacher's project, P5's response indicated that the ability to understand critical thinking may be limited. Because P5 seemed to be familiar with only math projects, the response suggested that P5 does not recognize that critical thinking standards occur globally in all subject areas. As a result, P5 may actually see limited potential for critical thinking standards to apply beyond a math classroom.

Student work builds project clarity. A second subtheme that emerged as a component of achieving clarity in the design of critical thinking elements was the role of student work. While teachers seemed to indicate that building clarity around critical thinking design was difficult, they found that they could recognize it more clearly in students' work. P4 's initial belief about the order in which critical thinking skills develop was challenged after an examination of student work. Originally, P4 believed it would be easy to achieve clarity around critical thinking in project design but difficult to see and understand critical thinking in student work; however, P4 found the opposite was true:

> I feel like I am having a bit of a hurdle identifying it in my own design. Which was a little counterintuitive to what I expected coming in…I think as I go through a project and identify critical thinking in students' work, that it is going to give me more insight into how my planning has led to critical thinking...What I thought would be the first piece of where I would be able to identify the scaffolding needed for critical thinking which is in my own design is turning out to be more like the second piece of the puzzle. (P4)

After recognizing critical thinking in student work, P4, in effect, realized that student work samples improved clarity around critical thinking and the ability to design projects that enhanced critical thinking. P9 concurred, stating it was easier to recognize critical thinking in student work than in a project presented without student work:

> I find it harder to pick up critical thinking in other people's designs if they have not already done the project and they are not presenting the outcome. It is easier

> to work backwards with someone else's project than it is to work from the idea to pick the critical thinking standards and this is the end product.

If teachers find it easier to identify critical thinking standards after their students complete work than when they plan a project, they may have trouble designing projects that truly target critical thinking. Because they cannot identify critical thinking in their design, their students' work may not meet their expectations.

In contrast, P9 utilized a piece of the protocol process, the critical thinking stems the group designed to provide indicators of what critical thinking standards might look like or sound like in student work, to design a project. The stems enabled P9 to work backwards to plan a project without seeing an actual piece of student work:

> I feel like what you were saying about when people present a project they have done, I have an easier time picking out critical thinking, but when I am planning a project, if I know what the "looks like, sounds like" is, I can adapt it with my own design. (P9)

This statement suggests that the group's protocol process, which included these group-generated indicators of the critical thinking standards in student work, helped P9 to see the potential for critical thinking in future student work. However, P9's response suggested an inability to translate that same understanding or comfort to identify a specific critical thinking standard in a teacher's design. P9's response may also indicate that when teachers seek to develop projects with targeted critical thinking elements, they might first develop stems, as this PLC did, in order to help facilitate design.

Inspiration for yearlong design goals. A third subtheme that emerged around teachers' developing clarity regarding critical thinking in design was their ability to

design goals that target specific critical thinking standards as a direct result of other teachers' presentations. Teachers felt that because of others' presentations, they were inspired to build projects and lessons targeting specific standards for an entire school year. Teachers spoke of significant understandings they developed during others' presentations. These presentations inspired them to create substantial goals for their students to work toward over the course of an entire school year. P2 explained how teacher comments during one phase of the protocol process allowed for new insight into how student-developed questions enhance the overall quality of their understanding. As a result, P2 used the single critical thinking standard of students developing their own questions to develop an instructional goal for the year. It appears that teacher presentations gave teachers not only inspiration but also valuable insights into student achievement worth designing for the whole year.

> In the historical fiction presentation, there were final reflective comments made that resulted in a moment of, "Oh, that is so profound, that is such a big impact piece!" where students design questions and how students question. The better the questions they wrote, the better the outcome of what they wrote. In [one] presentation, one student had very simplistic kinds of questions and one had highly developed questions. The questions were designed first, and then what they wrote based upon them was so substantially different. There was so much more insight, so much to the piece that coming out of that, everything I am trying to deal with this year is on that focus piece. I chose three standards that I am working with, and one of them was from what I saw in that presentation. It directly influenced where I want to go and push for this year. (P2)

In this instance, P2 found that student work a teacher presented was so meaningful that it would become the focal point for an entire year. When P4 recognized that better questions impacted the outcome of student writing, this teacher developed a goal to use these types of questions to improve the overall quality of all students' writing. As teachers discover and share their understanding about student learning with the PLC group, and other teachers use these understandings to develop meaningful critical thinking goals, students may benefit from the PLC process as well.

P9 had a similar experience with the same presentation but combined it with insight from another presentation as the impetus to create a yearlong goal toward the critical thinking understanding of determining relevance of information:

> I had that same experience from both the research paper and historical fiction presentations, so much so that my goal this year is developing relevance. I saw that it bridges across the subjects. Kids have a hard time addressing relevance, critical versus noncritical to their work....The conversation about questions, if they are not developing good questions, then we saw their writing was underdeveloped. Either they were missing relevant information or in some cases had too much irrelevant information. I found that was really helpful in trying to think how I would get them to understand what is relevant and what is not and why information should be there. The related standard helped me from a special education standpoint in developing modifications and adding on to projects and curriculum.

P9 made two significant points. The first point is how critical thinking issues addressed through design for specific critical thinking standards can transcend subject areas. P9

seemed to indicate the ability to design for a specific critical thinking goal that students could achieve in not one but several subject areas. As a special education teacher, P9 appeared to be in a position to target determining relevance as an issue for students in several different subject areas. P9 could advance students' critical thinking through design modifications, and if done properly, could apply these design elements and modifications to many disciplines. P9 also seemed to demonstrate the view that if teachers design proper instruction for them, special education students are capable of achieving success in specific critical thinking standards.

The specific pedagogical approach of student self-reflection inspired P4. In this case, a teacher's presentation inspired P4 to focus on an approach, student reflection, instead of a particular standard. This teacher's inspiration led P4 to use students' reflections throughout the year to enhance their understanding, as well as P4's own understanding, of how reflection on their learning helped them acquire specific critical thinking skills.

> I was inspired to do the direct reflection by the research paper presentation. Where it had the scaffolding interactions with critical thinking standards, it kind of set the ball in motion for me with my overview for the year. I plan on trying to have conversations at the end of the year and throughout the projects that ask which pieces helped you get to where I was trying to get you to go in your thinking. Because I really think my hope is students will be able to identify critical thinking themselves by the end of the year and what I did to help. (P4)

In each of these cases, another teacher's presentation not only inspired participants, but helped participants understand what they wanted to do and ultimately impact how

students learned. If this type of inspiration spread around a school, it could lead to an overall improvement in project design that targets critical thinking standards and could ultimately improve the quality of student work within specific critical thinking standards.

Through a presentation, P3 found a potential pitfall to avoid in order to ensure critical thinking was not lost in the design:

> When the science research piece was presented, that was really an eye-opener because it spoke to the issue of whether, in the desire to collaborate, we don't lose the bigger picture, the critical thinking piece....That opened my eyes to pitfalls. I fall into it because of a sense, "I need to get done, so let me give this to the kids rather than letting them generate it themselves."...I realized if I start to rush it, I am going to lose, the kids will lose the most meaningful parts of the process.

In this instance, a potential weakness in a project's design inspired the teacher. P3 seemed to indicate the ability to notice flaws reflected in another presenter's project design. As a result, P3 recognized the need to prevent such mistakes to ensure students were challenged to achieve targeted critical thinking standards. P3's own project design may actually improve because P3 will avoid making the mistake seen in another PLC presentation.

Not only teacher presentations but also the protocol process the group utilized, inspired P4. P4 indicated the model could be used as a means to show student growth around specific critical thinking standards targeted as yearlong goals. When presenting the design of a logic project, P4 stated,

> A big question for math lab right now is, if the intent is not going to be to strictly review skills from the standard math curriculum, then how do we give and

> measure growth, and how do we make students aware of that? So one of my plans is to develop a general rubric based off of critical thinking skills that can be applied to each project with stems in the same way we did as a group. Say, for instance, the depth of "Consideration of Implications" using background information and other resources, and then specifically for this project, what would it look like referring to the movie portion, book portion, and reading packet pieces we will use? Students would be considering the implications of certain changes in time and dimensionality would impact life. This is a piece that is in need of the most development.

This teacher's developing clarity of project design was twofold. P4's plan, inspired by the PLC protocol, was to target specific essential critical standards for math lab students and use student work models to create a content-specific version of the "looks like, sounds like" stems the PLC group developed. Through these statements, P4 hoped to develop a student achievement rubric that students would then apply to their own work samples to demonstrate their growth in critical thinking around P4's targeted standards. This teacher's statements seemed to indicate the PLC had so much value that the design of a similar process for students could allow them to benefit in a similar fashion. P4 indicated that the PLC process, when applied to a specific group of students, could lead to student understanding and achievement in a critical thinking standard—in this case, the consideration of implications.

Pedagogical recommendations. A final subtheme that emerged around teacher clarity regarding critical thinking project design was the quality of specific pedagogical recommendations. In this subtheme, participants demonstrated clarity regarding critical

thinking design when they provided specific, targeted pedagogical recommendations that would enhance the quality of student achievement regarding a specific critical thinking standard. Teachers seemed to indicate that their suggestions would allow a teacher to better design elements that would ultimately lead to higher quality student work. When P6 presented a science research project, P2 provided specific feedback to improve the quality of the project. In this presentation, the science teacher presented a research project inspired by a novel read in an English language arts (ELA) class. P2 responded in this way:

> I put down, "How could the relationship between the research be made to the condition of the novel?"...I wonder if the question could be asked wherein the kids have to talk about how the disease or the effects could be similar to what they understand happened in the book, as opposed to here the disease is, here are the causes, here's the cure. That's more regurgitating someone else's thinking as opposed to having them research for the purpose of coming up with their own original work. How are these similar or different? If there is a research question specifically designed to it, they do all their research and then at the last moments of the process, and it may not be in science, say, "Okay, so your paper is done, now how would this be similar?" You start to get kids coming up with that original thought and explanation. Something more and more we are pushing them to be able to do by the time they leave here, and they want to see it when they get into high school.

In another instance, P3 explained how P2 could enhance a project for the specific critical thinking standard, assessing thinking. P3's comment about a student work sample

focused on how students could evaluate the quality of their sources and justify their selection of sources in order to attain the critical thinking standard of assessing thinking:

> In Evaluation B—I think Standard Number 15—I really liked [the student's] answer: "I worked through my confusion one way by disregarding one of my sources. I learned that not every source is correct." So there is that sense of evaluative nature, evaluating sources, which can be really trying for kids who have never done that before. I feel like now [the student] understands [the student] may need to go through several sources and evaluate each one. That's really important for them to understand because when they get into high school, they will have to do that pretty independently. I was wondering if there is a way to justify [the student's] sources. "I chose my sources because this was a good source or a reliable source."

When speaking about P3's research-based writing project, P10 provided a specific design recommendation to enhance student work regarding sources:

> It's about the fact checking. I wonder if you gave the students, or if you asked them to explicitly state their process for fact-checking their sources. In other words, "Here is a source and it gave me a great idea. How many other places say that?"—to get reliability. Maybe a peer-review process would be helpful.

In each of these instances, PLC group members provided the presenting teacher with targeted, specific design elements that could ultimately enhance project quality. These recommendations, within a PLC presentation, seemed to indicate that these teachers had clarity of many critical thinking standards and were able to apply their understanding across disciplines to help other teachers make design changes to their

projects. Such specific recommendations may ultimately enhance the quality of projects and the level of student performance.

Teachers' growing clarity around critical thinking design generally improved through the PLC protocol process. As teachers observed other teachers' presentations, they were increasingly able to identify elements of critical thinking in design. However, they indicated that the presentation of student work was a key factor in their growing clarity regarding the elements that built students' critical thinking. Teachers also seemed to indicate that the PLC protocol process helped to build clarity of design because it inspired them to target critical thinking standards as a yearlong goal. These teachers found that significant student achievement in specific critical thinking standards was a focus worth designing around for an entire year. Lastly, the specific nature of teachers' comments to teachers who presented projects indicated their clarity of critical thinking design. When providing feedback during presentations, teachers provided the presenting teachers with very clear pedagogical recommendations; these recommendations indicated that if teachers implemented these design elements, heightened student performance around a specific critical thinking standard was achievable.

Confusion Around Students' Critical Thinking

The third theme, confusion around students' critical thinking, evolved from Interview Questions 3–6, which were designed to evoke emerging understanding about the second broad research question: teachers' understanding about students' critical thinking. Again, the participants framed most of their responses within the critical thinking standards.

General identification. One subtheme that emerged was teachers' perception that they could generally identify critical thinking in student work or identify a lack of critical thinking in student work. However, they could not identify what aspect or standard of critical thinking they were observing. P10 stated,

> I think I can see it when a student has it, because it looks like or sounds like something from our standards. I think I can see it when a student doesn't have it at all, but I don't know if I can see the beginnings of it.

P5 agreed, stating,

> Like [Participant 10], I can see it when it's there, and I can see it when it's not there. I think I can see critical thinking in students or what I use to think of as critical thinking. I'm not sure of whether I can identify "This is critical thinking because of Standard 5." But my perception of critical thinking hasn't changed, but maybe it has gotten more specific now that there are those standards that identify pieces of it.

P5 appeared to recognize that the understanding of critical thinking had changed but could not articulate the relationship between specific aspects of student work and specific critical thinking standards. Interestingly, P5 commented on the ability to see when critical thinking was present but could not identify which critical thinking standard was apparent. This may suggest that this teacher is actually confused about where specific standards are evident in student work. In fact, the comment may suggest a broader confusion about critical thinking. When P5 stated that the understanding of critical thinking had not changed but had become more specific, P5 suggested her understanding of critical thinking already existed but became more specific. P5 seems unable to

recognize the contradiction in these statements. P5's failure to recognize specific standards of critical thinking combined with P5's belief that previous perceptions of critical thinking have not fundamentally shifted indicate an overall simplification of critical thinking.

When providing feedback to a presenting teacher, participants' comments about student work suggested only a generalized understanding around students' critical thinking. In some instances, teacher comments about critical thinking lacked descriptions regarding the degree to which students successfully engaged in a critical thinking standard. In other instances, teachers were unable to articulate the relationship between the specific aspects of the student work and a specific critical thinking standard.

When commenting on a piece of student work during the PLC protocol process, P1 reflected confusion around whether students exhibited a critical thinking standard. In the following statement, P1 provided feedback on a student's written reflection about a research piece for a presenter:

> I like the A evaluation; the second part of it you say, "State your topic sentence and then reflect back. Does your paragraph really reflect that?" It seems very basic, but that's what kids need to do. It seems like it's more in seventh grade, but I guess it's really everywhere. And when thinking about trying to get information out in reflections, the more specific you can be, the more likely they are to answer the way they actually felt.

P1's focus on the value of the reflective task rather than the work the student generated is noteworthy. This teacher's comment suggested a weakness or confusion in the ability to

demonstrate a true understanding of how the student's work applied to a particular critical thinking standard.

In another instance, P7 provided feedback during a presentation on a student work sample from a historical narrative assignment. P7's comment seemed more like a question than a comment on the student's work, but then it moved into a more direct statement that provided appropriate jargon relating to questioning and, perhaps, critical thinking: "I was just noticing the same thing. Were they given any examples or gone over questions: open-ended versus close-ended questions? Not just, 'When did the Dust Bowl start?' but asking those questions and adding, 'Why?' or 'How come?'" When I triangulated this teacher's statements with the student work and teacher field notes, they suggested a simplification of critical thinking that was not apparent in the student work. This comment reflects the teacher's perception of what students would or would not do if they displayed critical thinking when designing a research question. While this feedback may help the presenting teacher generate an idea of what a critical thinking standard might look like in a piece of student work, this feedback does not actually address the work the student actually produced. The comment may suggest that the teacher is unable to recognize the degree to which a student produced something that reflected a specific critical thinking standard.

In another exchange about the same piece of historical fiction, P9 commented on a specific aspect of a student's piece of work and tried to connect it to a specific critical thinking standard, with an interjection by P8:

> One of the things I think: The highlighting and numbering source information is really good because it forces them to go back and look at their work and that they

are using the research they generated. That is Standard 3, I think. I don't know if that's right. Oh yeah, it says, "My searches lead me to more information I understand." (P9)

Wouldn't it be Standard 23? (P8)

Yeah, it would be 23, and 20, where it's an application of a concept. And then you're applying to the narrative based. The only thing I wondered: Is there a way to push that a little more, as part of the revision process, for the kids to assess?

Okay, so I put it in here, "But does it work in here? Should it be in another place in my narrative? Could I further develop that piece? Is there more information from this source that I could insert here, and why?" (P9)

In this exchange, both participants indicated confusion about which specific standards of critical thinking the student work demonstrated. Although P9 tried to offer a suggestion to enhance the quality of student critical thinking, the suggestion created a dilemma for the presenting teacher rather than offering a viable suggestion to improve students' thinking. The confusion over the application of a specific critical thinking standard to a piece of work could indicate teacher confusion over whether students are achieving the learning goals set forth. It could also contribute to confusion when teachers design and eventually modify existing projects to achieve those critical thinking learning goals.

Gradations. A second subtheme regarding confusion in teacher perceptions of students' critical thinking was teachers' ability to identify and explain degrees of critical thinking in student work. Teachers' perceptions reflected difficulties identifying early stages of critical thinking and increasing the quality of critical thinking. Teacher

perceptions also indicated confusion around what led to students' acquisition and development of critical thinking.

P10 stated, "I don't know if I can see the beginnings of critical thinking. I'm not there yet—when a student is starting to do it and trying to draw that out. I don't know that I'm there yet." P3's comment reflected confusion over how to get non-critical thinkers to begin thinking critically:

> I guess the big question for me is for students who aren't doing it. You try thoughtfully to incorporate them into the whole process. The kids who aren't doing it, it's really frustrating and confused. How do I take baby steps so I can start to see it when it's not there?

P1's comment reflected confusion over the level of critical thinking students demonstrated when their work reflected different actions and different standards:

> I think my problem comes more from the fact that there are so many different levels of critical thinking, so whether it be something so basic as their making news broadcasts on the colonies, for them to weigh "Is it really important for us to include this story, or include that?" In making that decision, they have used critical thinking decisions, but it might be a basic use of it. But there are other ways that when they maybe write a particular script for the broadcast, there might be different standards shown; they might be deeper and, at least in the way I'm seeing them. So when I grade the project, I thought I would think about the standards, and when I write a reflection, the kids are at another point. I can see how much thinking was going on and how much is just spitting back what they were already safe in the knowledge of instead of exploratory knowledge.

With follow up, P1 stated that "different standards were reflecting different kinds of depth or were more challenging." P1's perception regarding the gradations of critical thinking focused on how difficult the standards were in relation to each other. Rather than explain the students' critical thinking in relation to the quality of achievement within a single standard, P1 based the degree of critical thinking on the attempted standard. P1 indicated that decision making around a news story demonstrated critical thinking rather than noticing that there might be gradations of student success within each standard. When P1 stated that different standards are more challenging, P1 only seemed to recognize that some standards are more complex. P1 was unable to discuss the degree of critical thinking a student work sample generated and, rather, stated that students' advanced critical thinking could reflect only in the standard they attempted. P1's perception indicates that students' success as critical thinkers would not be based on the quality of their work but on the standards addressed in a project.

In another instance, two special education teacher participants commented on the confusion they felt regarding their students' critical thinking. In their view, it was difficult to understand why evidence of critical thinking in their students seemed so random. Additionally, one of them seemed to indicate confusion about how to develop critical thinking in students when these students' work showed only glimpses of a specific critical thinking standard. P8 commented,

> I think I see glimpses, and I almost feel like it's almost random, but at the same time do agree that some standards will take you further and some are more basic. And it seems as if the more basic ones, that I get glimpses of critical thinking in students. I definitely feel [that] for me, I can identify critical thinking in students

> who have it, and yet it's really hard to try and move those who have glimpses into something more, or more consistent, and I'm not sure if it's the way their minds work or how to get them there faster.

P9 also commented on how critical thinking develops for special education students. P9 felt that since evidence of critical thinking was so random, it was difficult to anticipate how critical thinking would develop from design to student work:

> You see flashes of critical thinking, but I've found no matter how the lesson or project is designed, it's random. The standards I would think I would see come in, I don't, and standards I was sure they wouldn't get, I do. I still can't figure out why. Why have a glimmer of this one, but the one the work was designed around, they didn't? I guess that reflection or evaluation piece is really difficult.

Interestingly, both special education teachers felt their students not only were capable of critical thinking but also could engage in it during lessons and projects. Yet, it seemed that of all the teachers in the PLC, special education teachers could best understand how to move students into achieving targeted critical thinking standards and devise procedures and lessons to help students become more proficient in using the critical thinking standards. These teachers' confusion could ultimately compound their students' difficulties, since special education students' learning issues already contribute their difficulties with critical thinking. The special education teachers' confusion surrounding their students' critical thinking could potentially make the instructional design of the critical thinking standards for a project even less effective for their students when compared to regular education students. This is significant because, in addition to developing targeted approaches for the development of critical thinking, special

education teachers would likely need to modify those pedagogical approaches to meet their students' learning needs. Since confusion compromised their understanding of why students could or could not engage in specific critical thinking standards, it may also prevent them from designing instructional modifications to meet their students' needs.

Clarity Around Students' Critical Thinking

A fourth theme that emerged through the data analysis process was a sense of clarity regarding the second research question: teacher perceptions of students' critical thinking. Teachers exhibited a sense of clarity when they identified specific critical thinking standards in presentations and related them to student work. Another subtheme that emerged related to clarity was the teachers' ability to identify student examples of critical thinking and then provide specific approaches to help build higher quality critical thinking. A third subtheme reflected clarity regarding an emerging understanding of the role of parroting in developing student critical thinking. A final subtheme was an emerging clarity of the importance of students' ability to identify critical thinking.

Specific identification in student work. Specific identification of critical thinking in student work was one subtheme that emerged regarding teacher clarity of students' critical thinking. In these instances, participants were able to provide specific references to student work and were able to explain either how the work related to critical thinking or how it specifically linked to a critical thinking standard. In one instance during a presentation of student work, P4 not only discussed how student work reflected a higher degree of critical thinking but also described indicators within the work that involved higher quality critical thinking:

> I see very basic descriptive, factual questions: "How did the Dust Bowl start? How did it affect families?" where the second student asked, "What is the difference between life before and after the Dust Bowl? What was the reaction to the Dust Bowl? What options did people have?" Considering alternatives is a very good question. These two questions on this page not only end with a question but seek the why? To me, those are signposts of higher order thinking.

P2 commented on the same student work sample and expressed how specific aspects of the student work were reflective of several critical thinking standards:

> I want to mention one more: Standard 23 was apparent to me. I found it interesting that the one student has so much more understanding of the conflict that was caused by the dust storm, that the parents argued [that] there was stress between the two of them that it doesn't go away; it's a repeating argument which leads to stress on the child, which then eventually leads to the stress of the father abandoning them. Really good, high-end understanding and ability. In fact, it covers more than Standard 23. It seems to be reflecting point of view and empathy, that the student is able to see through those pieces of factual information. Obviously, something that was picked up in the facts but then able to translate it into a story was really nice.

P4's first comment demonstrated clarity because P4 was able to articulate how the first questions the student designed were basic and factual and why the later questions were more significant. In the second comment, P2 was able to explain how the specific pieces of the student's writing related to the specific critical thinking standards of point of view and empathy. P2's's articulation of how specific aspects of the student's work

provided evidence of specific critical thinking standards indicated that some teachers gained insight into specific examples that reflected students' high-quality critical thinking, rather than making broad or simple references to critical thinking without specific evidence as support. Teachers who identify specific examples in students' work could then provide other teachers, as well as their students, with evidence or models from student work samples or teacher-developed samples that demonstrated critical thinking standards. Ultimately, these specific references to student work could help teachers and students better understand what constitutes high-quality critical thinking.

Identification of critical thinking tied to suggestions for advancement. In an even more explicit vein, a second subtheme emerged in which teachers not only were able to articulate specific instances of critical thinking and relate them to standards but also were also able to offer specific targeted approaches to help advance the level of critical thinking. P3, in describing a specific piece of student work, stated,

> In Evaluation B, I think there is Standard 15. "I worked through my confusion one way by disregarding one of my sources. I learned that not every source is correct." So there is that sense of evaluative nature, evaluating sources, which can be really trying for kids who have never done that before. I feel like now she understands she may need to go through several sources and evaluate each one. That's really important for them to understand, because when they get into high school they will have to do that pretty independently. I was wondering if there is a way to justify her sources: "I chose my sources because..." or "This was a good source or a reliable source."

Similarly, while speaking about another piece of student work, P2 explained how the two pieces of student work could be used as tools to enhance the quality of critical thinking in several standards:

> I wonder, in the future, if the focus would be to take the mini-lesson idea on questions, to take the two forms of questions and make a comparison between the two and ask for better questions out of students or to provoke better questions. I just wonder if a better set of questions would lead to better Standards 2, 3, and 4 out of students. There's examples of intellectual empathy, but the point of view and empathy of one sample to the other almost seems to originate from the types of questions each student wrote, and if you focus there, I wonder if the next steps would lead to a deeper understanding instead of trying to get to it after the fact, focus on the earlier step. Would it lead to better outcomes for the first student?

P2's comment was significant because it not only included a specific pedagogical means to improve instruction for a specific standard, but it also included an explanation of how the teacher could improve the student's performance. This type of meaningful commentary could then translate to higher performance in the critical thinking standards across disciplines. P2's comment also suggested that teachers in the PLC whose understanding of critical thinking standards encompass both identification and pedagogical application could recommend pedagogical approaches to other teachers to maximize their students' performance on the projects.

Student parroting. A third subtheme emerged regarding the role of students parroting information as a means to help develop critical thinking. Teachers expressed that, as a means to develop students' critical thinking, students should mimic the

language and actions of critical thinkers so they could eventually begin to act independently and advance their own abilities to think critically.

> P4 described a perception about the development of student critical thinking:
>
> I feel like I'm getting much closer to seeing gradations in the thought process. To clarify, how I can put this? In my approach, I've been calling it *specific*. Essentially, we started the year with a very broad discussion of what these mean, and then with the first project I'm asking the students to be very, very specific about what they've done or said. I'm asking for specifics in two areas: specifically talking about actions related to the project and then specifically talking about a certain critical thinking standard. So what I'm noticing is, the students who really don't get it at all just spit back that global language at me, and as I see student comments and reflections getting more and more specifically tailored to the project but to the critical thinking standard they've chosen to reflect upon, I feel like I'm starting to get a better sense of where they are in advancing their thinking. And for me, I think it's just a matter of amassing more and more examples of how a student phrases this through every reflection.

In a follow-up comment, P8 noted,

> I want to go back to what [P4] said about students just spitting out what we gave them. I think some kids really need that direct instruction: "This is what we are looking for." And until they can see it and hear it and know based upon what we've said, they do have to work through that. "Oh, this is what they want." I kind of see it, and just giving it back is maybe practice for them. And until they can stand on their own, they do need to be able to see it and give it back to us.

P4 stated that this use of imitation to develop student critical thinking was appropriate because the participant actually used the same PLC tool the group used. P4 felt it was appropriate to honor the process the PLC used and make it valuable for students as well:

> I feel like when I try and design for critical thinking standards specifically, I find myself trying to spit back something I've seen from this group, and for us to honor that, as part of the process, might be an important point to take away.

These comments suggest that the development of teachers' understanding of critical thinking is, in many ways, very similar to the development of students' understanding of critical thinking. Teachers recognized that they encourage students to parrot back the language and specifics of critical thinking, just as teachers engaged in this parroting during the PLC as a means to develop their own understanding of critical thinking standards. Likewise, teachers who had a general or vague understanding of critical thinking were similar to the students who needed the direct instruction as a way to help practice critical thinking. When teachers recognized that the process of understanding and developing critical thinking in their students was similar to their own development, they were able to utilize metacognition not only to develop clarity around their own critical thinking but also to teach their students to do the same.

Student identification. A final subtheme that emerged relating to teacher clarity of students' critical thinking was the role student identification of critical thinking plays in improving critical thinking. Some teachers commented on the importance of students parroting back information as a tool to enhance their critical thinking achievement. One

of the participants responded to another's comments about students mimicking what they had heard. P2 stated,

> A couple thoughts just came to me listening to [Participant 4]. The first is something I tell my students throughout the year: "First we mimic a certain thing we see or hear in someone else's work that we wish to also do. Eventually, we grow comfortable and then we do it independently." The other thing that occurred to me is that it is as important for students to recognize critical thinking as it is for us to recognize it.

Several participants responded to this statement. P5 agreed, P3 felt that at some point students must, and P4 felt it was most important. I then questioned other group members about whether they felt students could see and recognize critical thinking and recognize it in other students' work. P9 responded by stating,

> I think they can, but they identify it differently. I think they are looking at it as, "This is good." We are looking at it as, "Are you thinking critically?" while they are not looking at it as, "Am I thinking critically?" but rather, "Am I doing it right? Is this the right answer?" I don't think they have been able yet to specify that, "Teachers want me to do this because this is thinking critically."

P2 expressed a perception that indicated students and teachers follow similar paths in their understanding and articulation of critical thinking standards:

> Students may not yet recognize the language of critical thinking, but instead they are using, "This is good" because they can't articulate why, and I also wonder if that's what we teachers tend to do? It's good; I can't explain why it's good because the right language for it isn't available, so it's just good.

P10 then admitted,

> I've never asked that question, so I don't know. I've never asked students to say, "Do you see critical thinking?" or a paraphrased version of the same. I've asked them to talk about each other's work, but never about critical thinking specifically.

Yet, P10 also recognized the potential for students to discuss critical thinking explicitly. P10 saw how, in music classes, students could use critical thinking standards to expand and deepen their feedback about one another's projects:

> In the music technology class projects, the kids are talking about each other's work and why it is good and why it isn't good, but they are not using [the] critical thinking language we are using and they are not talking in ways we are talking about critical thinking. They might start to, like, when you were saying before, when you said showing glimmers of it, "I like how you did this section or that section," but it's after I prompt them to go further by asking them to talk about a specific standard in relation to what they like.

Two other teachers then offered suggestions for how teachers could use rubrics and reflections to help students find and articulate their understanding of critical thinking. P3 stated,

> I think rubrics are a really good way to bring critical thinking into student thinking because it gives them the language to work with it. In ELA, the ideas portion of a rubric gives a lot of freedom to look at the standards we are looking for, and the kids will start to use the language because they are forced to look at

the rubric when they are looking at each other's work. They can go in and say, "This is an example of this because this is why."

P1 stated that students could also use the "same rubric language to help articulate their understanding in learning reflections as well."

Teachers again seemed to recognize the value of their own experiences in helping them determine how to ask students to understand critical thinking. Through all of their comments, it became apparent that teachers were developing a sense of clarity of how to use similar experiences and language of the PLC to promote similar learning and understanding in their students. When they asked students to reflect on their work, teachers were actually asking students to engage in the same types of reflective practices the PLC engaged in as part of its protocol. Because teachers asked their students to utilize the same language they used, teachers could easily see growth in students' understanding of critical thinking behaviors, as well student products reflecting critical thinking. When teachers give students the means to talk in a common language, teachers may develop a means to understand fully what students know about the critical thinking standards they want students to improve upon.

Nonconfirming Data

In this study, several teachers' perceptions were considered nonconfirming data. Allen and Blythe (2004) stated that protocols succeed because the systematic talking and listening steps incorporated to help produce trust between group members generate a creative tension. Several participants, including P3 and P7, expressed their sense of insecurity about presenting to the group. P7 expressed insecurity about presenting to the group, but then denied having those fears. P10's contention contradicted Allen and

Blythe's point that the systematic talking and listening steps allow teachers to engage in a constructivist effort to address an individual teacher's focus. In addition, P10 expressed a vastly different view than Allen and Blythe's about the advancements teachers gain as members of a protocol process. Allen and Blythe argued that teachers engaging in a protocol process gain insight from the conversations and then apply their insights in their own classes to their own students. P10 stated exactly the opposite through the perception that even though P10 participated actively in the PLC, the participant did not develop a clear understanding of critical thinking.

Evidence of Quality

A triangulation of the data analysis revealed four themes. These themes emerged as I completed itinerate data analysis utilizing teacher field notes and transcriptions from teacher presentations of projects and student work. I sent each participant transcriptions of PLC presentations for member checks. I developed interview questions to help answer the research questions. I designed follow up questions during the interview to help further address emerging themes. The final piece of triangulated data was a transcript of a group interview. After the group interview, I sent all PLC members the transcript for member checks.

Conclusion

This case study explored the influence a PLC utilizing a protocol had on teachers' perceptions of instructional design for critical thinking and teacher understanding of students' critical thinking. Participants seemed to indicate both clarity and confusion regarding critical thinking. One theme that emerged around the first research question was teachers' level of clarity in instructional design for critical thinking components. In

a contrasting theme that also addressed the first research question, some participants demonstrated confusion relating to instructional design for critical thinking. For the second research question similar themes emerged when teachers examined student critical thinking. Teachers demonstrated confusion about the degree to which they were able to identify elements of critical thinking in projects and connect critical thinking standards to student work samples. A final theme that emerged was participants' clarity regarding their ability to identify and connect specific critical thinking standards to student work samples. Section 5 provides an interpretation of the 2 major themes of the study, recommendations for future actions based upon the research, recommendations for future research, a description of implications for social change, and a reflection of the researcher's roles within the district and the potential influences such roles had within the context of the study.

Section 5: Summary, Conclusions, Recommendations, and Reflection

Introduction

The purpose of this study was to explore the influence of a PLC, using a protocol, on teachers' perceptions of (a) the instructional design for critical thinking and (b) their understanding of students' critical thinking. This qualitative case study examined teacher perceptions regarding critical thinking in projects and student work samples. The study examined teachers as they followed an inquiry protocol within a PLC. PLC meetings were audiotaped and transcribed to capture perceptions of presenting teachers and the other PLC participants. Transcriptions were triangulated with participants' presentation field notes as well as a transcript of a final group interview. The PLC group's protocol used 23 of Paul and Elder's (2007b) 25 critical thinking standards to discuss project design targeting critical thinking and understanding students' critical thinking.

For over 25 years, both educators and legislators have expressed the desire to improve education in such areas as thinking critically, solving problems, posing and answering quality questions, and developing an integrated understanding of concepts (Assessing and Teaching of 21st Century Skills Project, 2010; Brooks & Brooks, 1999; CCSSI, 2011; Green, 2007; NCEE, 1983; Rotherham & Willingham, 2009). Legislative efforts to improve student achievement have failed to consider an underlying problem in education in the United States: Paul (1995) described students' fundamental inability to engage in critical thinking, but, more importantly, he asserted that most teachers are not good critical thinkers themselves and therefore cannot recognize critical thinking, or a lack thereof, in student generated work. Elder and Paul (2007b) further voiced this concern when they stated that teachers do not have a clear understanding of critical

thinking. Paul (1995) has long contended that teachers cannot recognize the difference between student memorization and regurgitation of information and students' independent development of reasoning and conclusions based on disciplined thought. Paul and Elder (2001) stated that inadequate teacher preparation programs have contributed to teachers' confusion. More recently, Paul and Elder (2011) suggested that shortcomings in teachers' own critical thinking ability may cause them to incorrectly evaluate critical thinking in their students' work. The authors argued that teachers must first commit to learning critical thinking themselves before they can increase their students' critical thinking competency.

This study's PLC started with a common goal: to allow teachers to share their experiences and understanding to help advance participants' learning around the instruction design for critical thinking and the advancement of student critical thinking. In the community in which the study was completed, teachers formed a PLC to act on a perceived need to improve students' critical thinking skills. The PLC allowed teachers to help create a school culture in which they collaboratively examined student work to target a pedagogical approach to help them reach their learning goal for students. Teachers regularly expressed their passion for what they were doing to their colleagues in internal presentations.

Research Questions

Two research questions guided this study:

1. What influence do inquiry protocols, used in PLC's, have on teacher perceptions of instructional design for critical thinking skills?

2. How does the use of inquiry protocols in PLC's influence teacher perceptions of students' critical thinking?

Four broad themes emerged from the data analysis. Two contrasting themes emerged from teachers' perceptions of critical thinking project design: clarity and confusion. Similarly, the themes of clarity and confusion also emerged around teacher perceptions of students' critical thinking.

Interpretations

Two significant findings emerged from the first research question, what influence do inquiry protocols, used in professional learning communities, have on teacher perceptions of instructional design for critical thinking skills? The first significant finding reflected a theme suggesting teachers' confusion when incorporating instructional design for critical thinking. One subtheme around design confusion related to teachers' general sense of confusion regarding the meaning of the critical thinking standards, which resulted in their desire for greater simplicity. Teachers' confusion about the meaning of critical thinking standards, as well as their subsequent desire to simplify them, reflects Paul's (1995) assertion that most teachers are not good at, nor can they recognize, critical thinking. Paul and Elder's (2007a) contention that teachers' understanding of critical thinking is not a certainty explains the teachers' confusion. Teachers who do not understand the meaning of critical thinking standards may not have developed their own critical thinking ability. Paul and Elder (2011) suggested that teachers who have not developed their own critical thinking will be unsuccessful in understanding or evaluating it.

A subtheme of design confusion was the lack of ownership some teachers felt regarding the critical thinking standards and the PLC protocol process. Some teachers' perceived lack of ownership in the PLC protocol process as well as the critical thinking standards, reflected several issues that can impede inquiry. Researchers have identified several issues that can impede the development of inquiry among teachers (Caine et al., 2010; DuFour et al., 2008; Hord, 2004; Scholastic & Gates Foundation, 2012; Weinbaum et al., 2004). One significant issue teachers face while engaged in inquiry is lack of time. In this case, some teachers' inquiry was stifled because they believed some classes were less conducive for critical thinking project design than other classes due to the time they had to spend on content. As a result, these teachers did not view the design of projects as a worthwhile investment. A second issue that can impede inquiry is a lack of community (Weinbaum et al., 2004). A lack of community results from a fundamental lack of trust among staff that influences their actions. This lack of trust impedes the open communication necessary for inquiry. Without trust between teachers engaged in inquiry, norms of communication are not established and a safe, supportive, and reflective environment cannot fully exist. Instead, this lack of trust contributes to a defensive environment in which teachers operate in a protective vacuum, guarding their practice rather than collaboratively reflecting upon it with an inquiry group. This protective mind set prevents the basis for inquiry.

Some teachers who spoke of a lack of ownership suggested they never felt comfortable with the idea of presenting a finished project to the group. Caine et al. (2010) attributed teachers' lack of comfort to shortcomings in the teachers' understanding of the environment established through procedures within protocols. Teacher perceptions

suggested that core-content teachers presented but noncore teachers were unable to gain a sense of an established, safe, supportive, and reflective environment conducive to their work. These teachers seemed to continue to isolate themselves in their individual classrooms in an effort to protect their teaching practices. When teachers embrace privacy and isolation and prefer not to challenge their conventional approach and expose their practice to scrutiny, they create a culture that, according to Deuel et al. (2009), is worth changing, not maintaining. Teachers who spoke of simplifying or dispelling the standards because they were not their own standards appear to align with the longstanding teacher perspective that educational research has no inherent value (Kennedy, 1997). Teachers' lack of ownership may be a form of resistance, which could also explain the thinking of teachers who sought to design projects around the previously understood concepts rather than targeting specific critical thinking standards in the design of their projects.

The protocol's success is a result of a "creative tension" (Allen & Blythe, 2004, p. 20) that exists due to several factors working in conjunction with one another. The first factor in creating the tension necessary for success is the specific talking and listening tasks required of group members. Yet, some teachers suggested the creative tension actually impeded their understanding and their ability to utilize the PLC protocol process to their advantage in project design. In these instances, teachers identified creative tension as an inhibitor to open and active dialogue they felt would have benefitted them. This perception discouraged them from bringing in projects. Their perception contradicts Allen and Blythe's (2004) final factor influencing the success of a protocol: The systematic talking and listening steps embedded in a protocol help to produce an open

discussion. Allen and Blythe further suggested that the protocol allows teachers to engage in a constructivist effort to address an individual teacher's focus while also allowing other group members to gain insights by "making powerful connections with their own teaching and students' learning" (p. 21). In this study, however, participants felt that the systematic talking and listening actually stifled their ability to have open discussion and gain insights.

In a second subtheme, teachers demonstrated critical thinking design confusion when they tended to accidentally include critical thinking standards. Teachers who spoke of accidental inclusion of critical thinking elements in their projects seemed to contradict the idea behind Stage 3 of Wiggins and McTighe's (2005) UbD. Stage 3 of UbD asks teachers to consider the extent to which their planning is "effective and engaging" (Wiggins & McTighe, 2005, p. 28). The accidental incorporation of critical thinking also does not reflect Paul's (1995) perspective that teachers should develop assessments requiring specific elements of critical thinking standards as well as plan how students will use these skills. Because the inclusion of critical thinking was accidental rather than designed, Paul's second teacher goal, to anticipate obstacles students would encounter so they can successfully get students to assess their own reasoning, would never have occurred. It appears, in these instances, that the accidental inclusion did not result from appropriate planning and anticipation and could therefore jeopardize students' performance as well as their ability to see any usefulness in engaging in their projects.

A second theme emerged from the first research question. Teachers reflecting this theme demonstrated a growing confidence in their ability to identify the elements of a project that would address specific critical thinking standards. Teachers identified two

factors that influenced their clarity regarding critical thinking design in projects: the role of subject areas and the inclusion of student work with project presentations.

Wiggins and McTighe (2005) supported the idea if teachers first saw a student work example from a project, they could design instruction around critical thinking more easily. The researchers argued teachers must plan backwards when designing to maximize student understanding. To accomplish this, teachers must be able to clearly articulate what they want students to know and do as a result of their plan. It therefore stands to reason that, in order to get students to this level, teachers would benefit from seeing the work they wish students to achieve. Wiggins and McTighe called this focus a "results-focused design" (p. 15) rather than a "content-focused design" (p. 15). This form of design may require teachers to complete the critical thinking product they want to see from students and then work backwards to design elements leading to the results they wish students to achieve.

Teachers emphasized that the PLC influenced them to create specific critical thinking goals for their instructional design throughout the year. DuFour et al. (2006) asserted that a PLC helps develop a vision that articulates practices, procedures, relationships, results, and climate of the school, which supported these teachers' perception. Teacher presentations that helped inspire other teachers' critical thinking goals seem to further establish the point DuFour et al. (2008) made when they stated that a PLC "motivates and energizes people, creates a proactive orientation, gives direction, establishes specific standards of excellence, and creates a clear agenda for action" (pp. 143–144). When teachers used PLC presentations as motivation to develop goals, they

created their own agenda for action that provided a singular focus benefitting their efforts and their students' efforts.

When teachers establish goals, these goals guide teachers on a daily basis and allow them to focus on the "right priorities" (DuFour et al., 2008, p. 159), gauge their success, and create an "action orientation" (p. 159). As group members articulate goals, Wenger et al. (2002) suggested they diagnose problems that resonate through and across teams. They also use their action orientation to analyze uneven performance levels within the group and work to establish the highest standards for all members. Those teachers who gained clarity around instructional design for critical thinking provided specific, targeted pedagogical recommendations for improving projects. Their recommendations, such as the significance of student reflections, helped to even the entire group's performance level of project design because as the group members provided feedback, they engaged in social constructivism, following Lambert's (2003) third and fourth elements of constructivism and Fosnot's (2005) second and third constructivist themes.

Design clarity was also apparent in participants' comments to the presenting teachers. In these comments, teachers offered targeted, specific pedagogical suggestions to presenting teachers to improve or enhance their critical thinking projects. The learning process became a social endeavor that challenged each individual teacher's understanding of the critical thinking around project design. Individual cognitive understanding of instructional design for critical thinking was no longer acceptable. The PLC forced teachers' isolated, individual understanding aside. The PLC forced all teachers to see project recommendations through the eyes of other teachers who supported the design of

a targeted critical thinking standard. The social constructivist influence on the PLC was evident as cooperating teachers expressed their understanding of critical thinking through targeted pedagogical recommendations. They shared their critical thinking schemata with other group members as they also helped to negotiate a new understanding of critical thinking for presenting teachers as well as other cooperating teachers. As a result, group members demonstrated shared knowledge and further demonstrated the value of their shared knowledge as they became inspired to target goals for their teaching that reflected their new understanding.

Two themes also emerged around the second research question, how does the use of inquiry protocols in professional learning communities influence teacher perceptions of students' critical thinking? The first theme that emerged was teacher confusion around students' critical thinking. In this theme, participants stated they only could generally identify critical thinking in student work or were unable to identify critical thinking in student work at all. In some instances, teachers' ability to identify critical thinking was limited to merely identifying the presence or absence of critical thinking elements in student work. They would generally recognize something as an example of critical thinking but were unable to specify the standard of critical thinking they observed in student work. Wenger et al. (2002) contradicted the likelihood of this occurrence because the teachers in the PLC had a common, stated goal. Wenger et al. would likely contend that PLC teachers' goals around critical thinking should have helped them diagnose problems such as the confusion around critical thinking in student work.

Paul and Elder (2007b) helped explain why a goal to design for and understand student achievement around critical thinking standards might not be enough. They

suggested that teachers do not have a clear concept of critical thinking and have not developed a systematic approach to include it in instructional design. Their assertion that teachers may not have a clear concept of critical thinking may explain why some participants did not achieve their goal of understanding critical thinking. Paul and Elder further indicated that teachers receive little preparation and training around critical thinking. Their ideas would certainly help to explain why teachers' ability to identify critical thinking standards in design and student work may be confused and how a lack of pedagogical training, or even their inability to think critically themselves, could impede their ability to overcome their confusion.

Teachers also exhibited confusion in their ability to identify developing degrees of critical thinking in students. The general lack of training and understanding of critical thinking could certainly undermine Wenger et al.'s (2002) suggestion that groups of teachers working together could diagnose problems that resonate through and across teams. The participants identified their confusion as the cause of their inability to see critical thinking and advance their students' critical thinking. Wenger et al. suggested that the group's action orientation would help teachers establish the highest standards for all PLC members. Wenger et al. also suggested that teachers' ability to analyze uneven performance levels, as well as their ability to identify early stages of critical thinking, to develop the quality of critical thinking in students, or to explain what led to the development of critical thinking in students are the result of the group's common goal. This ultimately leads to teachers' heightened understanding of students' critical thinking. In this case, gaps in individual members' critical thinking preparation and professional

development could jeopardize the PLCs ability to set and maintain high standards for all group members.

The participants' confusion in identifying early stages of student critical thinking as well as their confusion in explaining what contributed to the advancement of critical thinking directly relates to teachers' failure to implement Wiggins and McTighe's (2005) UbD elements in their design of student projects. The lack of design can lead to confusion in identifying the early stages of critical thinking in students or explaining what led to the advancement of critical thinking in some students. UbD suggests that teachers design projects not only around what content they want students to understand but also around how that content will reflect specific critical thinking standards. Wiggins and McTighe suggested that when designing projects, teachers must know what constitutes acceptable evidence of student learning. The determination of acceptable evidence occurs during the second stage of a project designed backwards. Teacher confusion regarding the identification of early stages of critical thinking as well as the precursors to the advancement of some students' critical thinking indicates gaps in teachers' understanding of the criteria they use to assess students.

Paul and Elder (2011) also suggested that teachers who do not yet think critically will struggle to recognize or evaluate students' critical thinking. Teachers may not adequately develop a plan for how students use specific critical thinking skills, nor will they anticipate obstacles that students may encounter. These shortcomings could impede their students' ability to assess their own reasoning (Paul, 1995).

Limited opportunities for student feedback may also contribute to teachers' confusion about student advancement in critical thinking. Paul (1995) and Wiggins and

McTighe (2005) agreed that teachers need to provide numerous opportunities for students to reflect on their own understanding and learning. If teachers are confused about students' critical thinking and do not provide students with opportunities to reflect on their thinking, they miss a key opportunity to understand their students' development of critical thinking. Students who do not reflect on their thinking are less likely to develop the metacognitive thinking necessary to understand their critical thinking. If students cannot demonstrate metacognition, teachers also may not have adequate information about student thinking and therefore cannot understand the development of their students' critical thinking. This confusion, therefore, ties directly to a breakdown in the planning stages that ultimately influenced teachers' understanding of students' critical thinking.

A second theme from the second research question was teachers' developing a sense of clarity around students' critical thinking. Teachers exhibited a sense of clarity in identifying and relating students' work to specific critical thinking standards. Wiggins and McTighe's (2005) Stage 2 of UbD supports teachers who exhibited a growing sense of clarity in identifying and relating students' work to specific critical thinking standards. Because these teachers saw critical thinking elements through the lens of acceptable evidence of attainment, they were then able to see it in students' work. Teachers' understanding of critical thinking was not limited to their ability to state whether it existed in projects or student work; rather, these teachers referred to specific examples and attached them to a specific standard of critical thinking to demonstrate their clarity regarding critical thinking.

Another subtheme related to teachers' ability to identify students' critical thinking and then provide a specific approach to help build higher quality critical thinking.

Teachers' ability to provide specific examples was especially significant because as teachers were able to identify how student work related to a standard, these same teachers were then able to provide targeted approaches to help advance the quality of the work students would produce. Another teacher could apply these specific instructional suggestions to improve student performance. In this fashion, participants provided presenting teachers with potential criterion-based information they could incorporate into student assessments. The suggestions and possible advancements could give the presenting teacher, as well as non-presenters, "powerful connections with their own teaching and students' learning" (Allen & Blythe, 2004, p. 21). In this manner, the protocol and PLC would not only help facilitate the presenter's understanding of student critical thinking but also help facilitate advancement of critical thinking in other instruction participating teachers have not designed yet.

A third subtheme reflected participants growing understanding of the importance of students' understanding their own growth in critical thinking. Participants spoke of the need for students to utilize parroting of critical thinking as a means to develop their own language of critical thinking. This, in turn, would also support the teachers' growing perception that student self-identification of critical thinking is a significant factor in demonstrating understanding and successful teaching of critical thinking. Paul and Elder (2007b) supported the notion the participants identified. As students parrot and are eventually asked to self-identify critical thinking beyond parroting, they are given the opportunity to self-reflect on whether they meet the intellectual standards of clarity, accuracy, relevance, logic, breadth, precision, significance, completeness, fairness, and depth, as well as the intellectual traits that include intellectual humility, autonomy,

integrity, courage, perseverance, empathy, and confidence in reason. Teachers who provide students with the tools to reflect on their own learning would also gain a heightened understanding of how students think and perceive their own learning. Students' articulation of their learning would provide teachers with additional data to help them further improve critical thinking in their less advanced students. These insights may ultimately provide the teacher with relevant information that can help advance the understanding of all students and even provide opportunities for student-to-student teaching involving critical thinking standards.

Implications for Social Change

The group members who expressed a desire to present to a larger community in regional or national conferences in order to expand their influence reflect the implications for social change. Hopefully, as teachers realize the influence a small group can have, they, too, will take action. Teachers who embrace a PLC can utilize it to make their passion for student learning a reality. The study's implications for positive social change are twofold. The first implication is in the participants whose shared knowledge enhanced the design of instruction that builds critical thinking. The second implication is in the participants' newly developed understanding of students' critical thinking. The participating teachers' actions can initiate a ripple effect. Their collaborative knowledge and work can become a symbol of success to share as a model for fellow teachers within their district and for other teachers seeking to expand beyond isolated classrooms and use protocols to design instruction that significantly influences student's critical thinking. As more teachers engage in PLC activities, the quality of the instructional design, as well as teachers' understanding of students' critical thinking, will improve.

Recommendations for Action

Recommendations for action are the result of several findings. Teacher training around understanding critical thinking standards, when included as part of the PLC process, would ensure the future success of the PLC's work. Teachers who seek to improve the quality of their assessments and student achievement in critical thinking need to have a strong foundation of knowledge. This study indicated that teachers who exhibited a lack of clarity regarding critical thinking in design as well as student work did not have the same foundation of understanding as other teachers within the PLC group. This lack of clarity suggests a need for ongoing support and an opportunity for teachers to voice their confusion about critical thinking as it relates to their experiences and understanding. If the PLC provides an opportunity for its members to voice confusion, the PLC group can help ensure a uniform level of understanding to allow all group members to share a high standard for developing critical thinking projects and evaluating student achievement in critical thinking.

As states overwhelmingly adopt the Common Core Standards and tie teacher evaluations more closely to student achievement, consistency of teacher understanding is particularly necessary for future action. The Common Core Standards seek to raise students' critical thinking levels, which will inherently require student evaluations to reflect these same standards. If student achievement in critical thinking is a measure of teacher performance, then it is strongly recommended PLCs work together to train one another and ensure common understanding around a protocol process.

The findings of this study suggest that teachers, like their students, will hide their confusion to avoid the perception that they are not as capable as their colleagues are. It

seems necessary to recommend that teachers participate in training around critical thinking, but this training should include a reflective piece to ensure that teachers are able to self-identify any shortcomings. When teachers identify areas of limited understanding, other teachers can provide non-evaluative feedback to resolve their fellow teachers' critical thinking confusion. Through such action, teachers receive the self-improvement opportunities they often provide for their students. Consequently, teachers improve their critical thinking clarity to influence their own teaching practice and their students' critical thinking outcomes.

The dissemination of this study begins within the district in which it originated. The district of this study developed a state-mandated evaluation system that emphasizes the Common Core Standards. It is therefore incumbent upon the teacher participants to share insights and new understanding around critical thinking and protocols during department meetings, staff meetings, as well as other PLC meetings. The study's findings will help build quality instruction within the district and across departments. Additionally, some participants expressed the desire to share the findings of the study through regional associations and to present to a larger community of teachers in similar districts and settings as those of this study. Through this desire, it is conceivable that participants can be enticed to help coauthor an article to highlight the success of designing critical thinking projects across disciplines and the development of new understanding and the influence on student's critical thinking.

Recommendations for Further Research

This study allowed me to evaluate participants in a PLC as they utilized a protocol to develop perceptions of designing critical thinking projects and students' critical

thinking. Results of this study suggest several areas for further research. An initial advancement in research could focus on more targeted critical thinking standards as clusters. For instance, the researcher could ask PLC teachers to focus on what Paul and Elder (2007a) called the universal intellectual thinking standards, universal structures of thought, or intellectual traits that develop critical thinkers. If they target a specific cluster of standards, participants and researchers could provide a more in-depth focus on establishing perceptions necessary to develop projects and advance student achievement within those standards. A focus on the targeted, smaller number of standards could help each presenter and participant refine perceptions and address issues found in this research that caused confusion. A more narrow focus could lead to a clearer development of the implications of clarity in design and student work and could further advance the understanding of teachers' perceptions of project development and their understanding of student work.

The narrowed focus would also support a second recommendation: to generate a research study that incorporates deliberate training of all participants in the value and process of protocols and presentations to the PLC group. As teachers gain familiarity, a facilitator could also incorporate targeted modeling and readings to support the role teachers play in a protocol. This facilitation would help teachers better understand how their role and the protocol process help to inform them as well as the presenting teacher. Teacher buy-in on a smaller number of standards could help advance clarity within the group and help expand the research on the clarity teachers exhibited regarding the development of projects as well as students' work within projects.

Reflections of the Researcher

My role in this research study was, to some extent, inextricably connected to my role as a teacher within the scope of the study. While I have no administrative or defined leadership role in the school district or the research site in which the PLC functioned, my professional relationship with my fellow teacher participants and reputation in the school likely influenced the PLC. I was able to function as an equal with my fellow teachers and avoid causing any undue stress to the group because I would not use their performance or involvement as an evaluative tool. Yet, my perceived reputation in the school and district as a serious teacher with very high expectations for my students and fellow teachers may have positively or negatively influenced my role in recruiting participants into the PLC. Consequently, the teachers who agreed to join the PLC had, at least to some extent, some relationship with me and therefore had an understanding of the high expectations under which the group would function and hope to achieve.

Because of my beliefs about teaching and because each of the teachers within the PLC chose to participate, I believe I may have had some preconceived ideas about the group and how the teachers in it would work together. I entered the study with the belief that all group members could and would engage in an honest and open attempt to learn and develop their understanding of critical thinking as it pertained to developing projects and understanding student achievement. These preconceptions may have resulted in a missed opportunity to have an open dialogue with group members who later discussed confusion and frustration about the PLC protocol and their understanding of critical thinking. I also may have underestimated the professionalism of some teachers, as they did not participate in presentations. I may have attributed their absence at meetings or

failure to present to professional obligations relating to their students or teaching responsibilities rather than to their confusion around critical thinking or their lack of buy-in in the PLC. The findings suggested that several teachers might have kept their confusion regarding critical thinking or frustration with the PLC protocol from the researcher or the group as a whole. These same participants may have discussed some of their frustration in isolation. Consequently, the group, as a whole, was unable to provide any clarification. This proved to be a missed opportunity to construct a common understanding and knowledge with the help of other group members or the researcher.

Similarly, my relationship with the participants also may have helped to provide a heightened engagement and participation, which may have influenced some participants' clarity regarding critical thinking. Some group members seemed to engage in a particularly active manner as presenters and group participants; there were also passionate colleagues who extended the critical thinking conversation beyond the PLC and into everyday informal conversation with colleagues. Consequently, these participants appeared to have developed a much greater confidence and clarity around critical thinking during and after the study. The value of participants' trust and commitment within a PLC is particularly important to developing understanding around critical thinking. For teachers committed to their own understanding of critical thinking as well as their students' achievement in each standard, the PLC experience plays only a limited role. These teachers' desire to maintain a professional integrity in the eyes of their colleagues will take their commitment to critical thinking well beyond the PLC experience.

Conclusion

For almost 30 years, calls for improvement in student achievement have centered on higher order skills and critical thinking (Brooks & Brooks, 1999; CCSSI, 2011; Green, 2007; NCEE, 1983). Yet, research suggests that teachers are ill equipped to recognize quality critical thinking in students and they have not received proper training in teaching for critical thinking (Paul & Elder, 2001, 2007a). Now, as states across the nation have approved the Common Core Standards, the need for teachers to understand and teach for critical thinking is even more relevant (CCSSI, 2011). Through this qualitative study, I sought to build an understanding of teacher perceptions around planning for critical thinking in projects as well as student work as a result of working within a PLC utilizing a protocol for examining evidence.

Teachers' perceptions indicated the emergence of two divergent themes regarding designing instruction for critical thinking as well as understanding critical thinking in student work. Participants showed either clarity or confusion around critical thinking. Participant clarity around critical thinking indicated that the PLC teachers using a protocol demonstrated an understanding of critical thinking that influenced their own planning and influenced the planning of other participants. The result was the development of complex projects requiring higher levels of critical thinking, which influenced the development and quality of students' critical thinking. Participant confusion indicated a general lack of understanding of the identification of critical thinking in design as well as in student performance. Teachers' ownership of the entire PLC protocol process influenced their level of participation; teachers who did not gain a sense of ownership were unable to overcome their confusion. Their continued confusion

could leave them less equipped to develop projects due to their limited understanding of student critical thinking. Those teachers who did not develop a sense of ownership in the PLC protocol process ultimately had little hope of improving their critical thinking understanding. Teachers' ownership in the PLC protocol process is essential to ensure the future success and advancement of critical thinking in teachers who design projects that build and assess critical thinking in students.

The potential power of the PLC is evident in this study. Rather than evaluating the efficacy of a PLC on teacher evaluations and test scores, this study gave the PLC a broader, more meaningful value. Teachers working in a PLC can influence the quality of critical thinking in schools. If the Common Core Standards are effectively implemented and proposed teacher performance reviews evaluate teachers based on those standards, teachers will need an effective means to raise students' critical thinking levels. A PLC focused on developing teacher critical thinking, designing high-quality critical thinking projects, and advancing students' critical thinking will empower teachers to improve their school's instruction and their students' achievement.

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Appendix A: Letter of Consent

Date 2010

Dear_____:

You are invited to take part in a research study, *Protocol use in a professional learning community: Implications for designing critical thinking projects and understanding student's critical thinking*. This qualitative case study will explore how teachers working together on a focused inquiry can use feedback from protocols to influence instructional design targeting critical thinking and understanding of students' critical thinking. You were chosen for the study because of your interest in critical thinking and involvement in the professional learning community focused upon this topic. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named Jeffery Rieck, who is a doctoral student at Walden University.

Background Information:
The purpose of this study is to address an existing problem which is that business, government and educational leaders have sought to improve the teaching of critical thinking abilities of students. While research on professional learning communities suggests a positive impact upon standardized test scores and teacher efficacy, there is an absence of evidence in the literature to understand how inquiry protocols used within the professional learning communities impact teacher's perceptions of critical thinking. Particularly absent is research examining the impact protocols have on teacher's perceptions of instructional design targeting critical thinking and understanding student's critical thinking skills. There is also an existing desire within the Irvington community to improve the critical thinking of students.

Procedures:
If you agree to be in this study, you will be asked to:

- Participate as a professional learning community member in presentations of student work or projects designed by teachers. Participants will fill out field notes as part of a data collection piece. Meetings will be scheduled by presenting teachers and will usually take place before school hours.
- Participants will be asked to present, at their discretion and availability, student work samples or a project for the professional learning community to obtain evaluative feedback from the group about student work or a project under development.
- Group members will be asked to participate in a group interview at the conclusion of data collection. The interview is expected to last approximately one hour.

Voluntary Nature of the Study:
Your participation in this study is voluntary. This means that everyone will respect your decision of whether or not you want to be in the study. No one at Irvington Middle School or Irvington UFSD will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind during the study. If you feel stressed during the study you may stop at any time. You may skip any questions that you feel are too personal.

Risks and Benefits of Being in the Study:
The risks to participants are expected to be minimal. Participants are not expected to complete any additional work beyond their normal teaching duties. The student work or projects they bring to the group are expected to be part of their regular teaching assignments. However, unforeseen factors could arise that could potentially pose an increased level of stress in your life which could be compounded by additional meetings with fellow staff members.

Potential benefits from the study are twofold. Teachers may gain shared knowledge of pedagogy and understanding of student learning and may apply it to instructional design to further student performance. Their work can be shared as a model for fellow teachers within their district and for others seeking to expand beyond isolated classrooms and use protocols to design instruction and understand student's critical thinking.

Compensation:
Group members will be volunteers in the study and will not receive and compensation.

Confidentiality:
Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via phone (917-771-6858) or e-mail (Jeffery.Rieck@waldenu.edu). If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 1-800-925-3368, extension 1210. Walden University's approval number for this study is **IRB will enter approval number here** and it expires on **IRB will enter expiration date.**

The researcher will give you a copy of this form to keep.

Statement of Consent:
I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By signing below, I am agreeing to the terms described above.

Printed Name of Participant _____

Date of consent _____

Participant's Written or Electronic* Signature _____

Researcher's Written or Electronic* Signature Jeffery.rieck@waldenu.edu

Electronic signatures are regulated by the Uniform Electronic Transactions Act. Legally, an "electronic signature" can be the person's typed name, their e-mail address, or any other identifying marker. An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically.

Appendix B: Critical Thinking—Protocol Field Notes

Presenter: _____ Subject Area: _____

Project Title: _____ Grade Level: _____

PLC Participating Teacher: _____

Targeted Critical Thinking Standards: (To be identified by presenting teacher)

1) _____

2) _____

3) _____

Description Notes:

Clarifying questions:

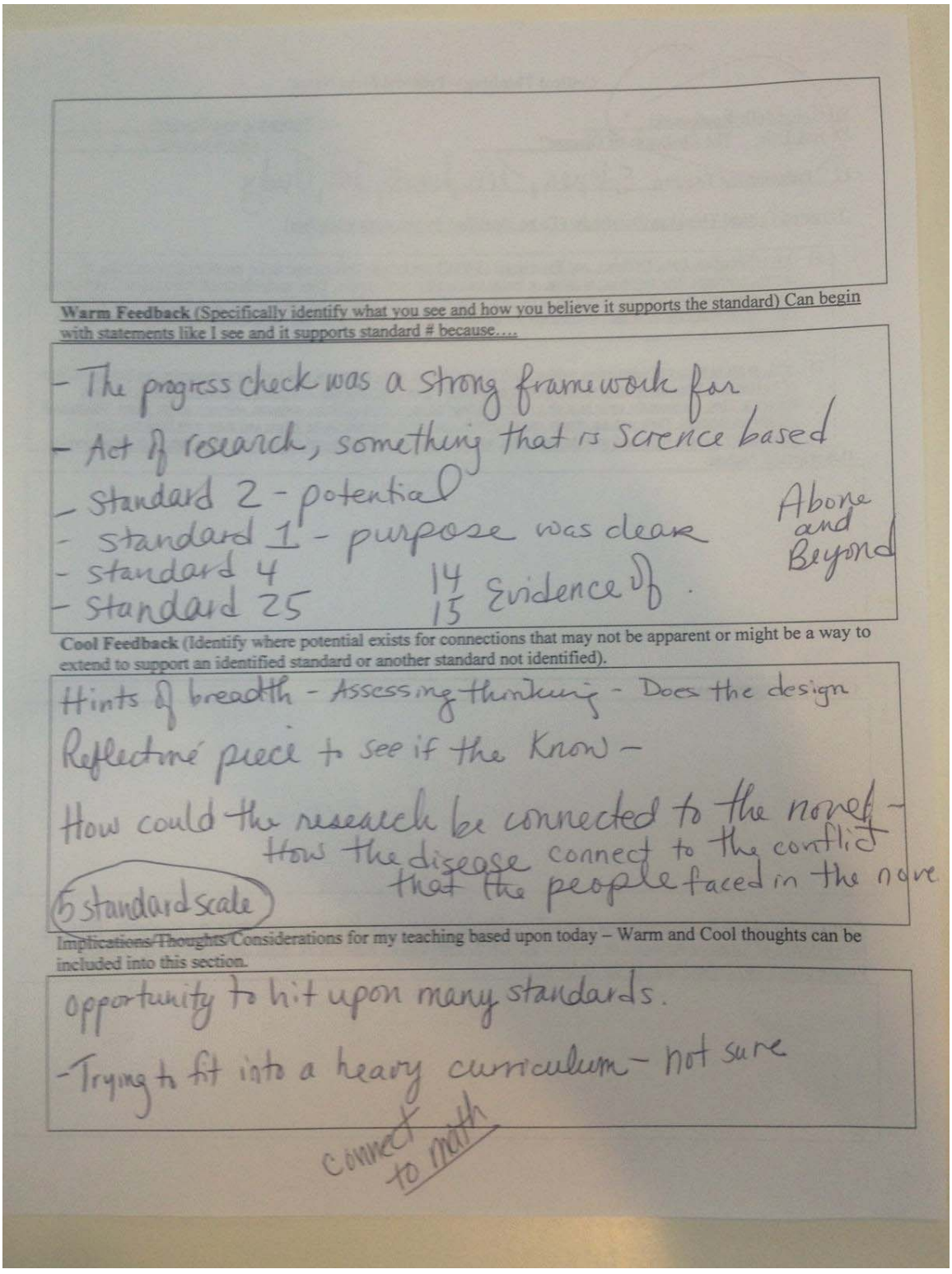
Critical Thinking Documentation (Specific evidence you see relevant to critical thinking standards. This can be evidence of targeted standard or another standard. This can be noted here or on the documents provide. Please attach any notes made to the field notes).

Warm Feedback (Specifically identify what you see and how you believe it supports the standard) Can begin with statements like I see and it supports standard number because…

Cool Feedback (Identify where potential exists for connections that may not be apparent or might be a way to extend to support an identified standard or another standard not identified).

Implications/Thoughts/Considerations for my teaching based upon today—Warm and Cool thoughts can be included into this section.

Appendix C: Presenting Teacher Sample Field Notes



Warm Feedback (Specifically identify what you see and how you believe it supports the standard) Can begin with statements like I see and it supports standard # because….

- The progress check was a strong framework for
- Act of research, something that is science based
- standard 2 - potential
- standard 1 - purpose was clear
- standard 4
- standard 25

Above and Beyond

14
15 Evidence of.

Cool Feedback (Identify where potential exists for connections that may not be apparent or might be a way to extend to support an identified standard or another standard not identified).

Hints of breadth - Assessing thinking - Does the design
Reflective piece to see if the know -
How could the research be connected to the novel -
How the disease connect to the conflict
that the people faced in the nove
5 standard scale

~~Implications/Thoughts~~/Considerations for my teaching based upon today – Warm and Cool thoughts can be included into this section.

opportunity to hit upon many standards.
- Trying to fit into a heavy curriculum - not sure
connect to math

Appendix D: Critical Thinking Standards (Paul & Elder, 2007a)

Standard	Describe specific evidence in student work or project. Please be as precise as possible in description.
1-Purpose, Goals and Objectives	Sounds like: Students: • Why are we doing this? • We are doing this because… • How will I use this… • I could use this when I… Looks like: Teacher: • Found in a purpose description (Hook) • Reflection question and response • Critical for students to understand initially • Content based: UBD—statements, comments and & writing by students that reflects "overarching understandings."
2-Questions, Problems, and Issue	Sounds like: • What do I need to know to answer a broad question? • How do we break down a broad question? • What are the steps we follow to answer a question? • What is the process we will follow to answer a question or complete a task? • Students: • First I am going to… • This question requires me to know… how to … • I can answer this question by … Looks like: • Process evidence for completing task, project, question • Teacher scaffolding to break down student thinking into steps
3-Information, Data, Evidence, and Experience	Sounds like: It is not students asking, Is this right? Students: (This is what teachers don't want to hear.) • Is this enough? How long should the paper be? • Am I done? What teachers do want to hear. • I used sources to help me find other sources. • My sources lead me to new information that I had to understand.

- How do I know this is correct? How can I verify this information?
- I thought the answer was going to be… but now I/we think it is this because we found out…
- We took our first answer and developed other alternative options because we thought of other options such as…
- We can explain the implications of our possible choices…

4-Inferences and Interpretations

Looks like:

- Teacher designed reflections to provoke such statements
- Teacher designed scaffolding to infuse discussions with statements by and between students

Sounds like:

- The (blank) is the cause of the (blank) because….
- The (blank) represents (blank) because…
- The (blank) is an example of (blank) because…
- I am assuming …
- If we grant this aspect of the argument is true then…

5-Assumptions and Presuppositions

Looks like:

- Student designed products reflecting Symbolism—characters in literature … advertisements messages….political cartoons
- Products could include their own design or writing pieces

Sounds like:

- Can articulate arguments that explain both sides of issues or arguments.
- Can explain where views come from and how they affect behavior and actions.
- Recognizes in others, assumptions that are based upon prejudices, stereotypes, biases and distortions.
- Recognizes own assumptions that are based upon prejudices, stereotypes, biases and distortions as well as own.

6-Concepts, Theories, Principles, Definitions, Laws & Axioms

Looks like:

- Can write arguments that explain both sides of issues or arguments.

Sounds like:

- Uses specific concepts such as Democracy, America, Free Market society is right to argue as correct or incorrect
- Applying a definition of one context to all contexts.(i.e., rhetorical devices)
- Using biblical teaching as literal or only symbolic to base arguments like same sex marriage is “wrong” or that bible is symbolism and cannot be taken literally

7-Implications and Consequences

Looks like:

- Checking and double-checking results.*
- Referring back to the original question or problem.*
- Referring to task checklist.*
- Social Problem Solving Model.
- Student reflections in which they identify what they know and have learned and how it can/will apply to future applications.
- Scientific Method (particularly hypothesis and implications)

Sounds like:

- A likely result of _____ would be…
- If I/we/they _____ then _____ is likely to occur.
- A reason I/we should do _____ is . . . .
- My result might mean or lead to . . .
- I wish I had known this when ____ because I could have use this on _____ and now when I do _____ I will be able to _____

8-Points of View & Frames of Reference

Looks like:

- Science labs that explain why the experiment results occurred using specific theory and relating to the specific results.
- Conclusion: Revising a hypothesis to reflect how the specific data did/did not.
- Essay that is outlined to demonstrate a logical organization and then ideas within the essay develop arguments in thorough manner to explain both points of view.

Sounds like:

- What do you mean when you say…
- Can you give an example.
- How can we verify or check that statement.
- Who can expand upon that thought…
- That doesn't make sense but this would make more sense…

Looks like:

- Listen to all points of view, arguments, examples and then makes informed decision based using specific criteria to justify decision.
- (Writing, oral, performance, behavior)
- Uses neutral language to express views (this may be vs. this is the only way) (they may have thought because vs. they were wrong)

9-Assessing Thinking

Looks like:

- Science labs that explain why the experiment results occurred using specific theory and relating to the specific results.
- Conclusion: Revising a hypothesis to reflect how the specific data did/did not.
- Essay that is outlined to demonstrate a logical organization and then ideas within the essay develop arguments in thorough manner to explain both points of view.

Sounds like:

- What do you mean when you say…
- Can you give an example.
- How can we verify or check that statement.
- Who can expand upon that thought…
  That doesn't make sense but this would make more sense…

10-Fair-mindedness

Sounds like:

- Is there anything else to consider…
- Does anyone else have something to add…
- It's not just your group, your opinion that matters.
- Wait, let ___ speak too.
- That's just as bad as when someone says the same thing about your view.

Looks like:

- Listen to all points of view, arguments, examples and then makes informed decision based using specific criteria to justify decision.
- (Writing, oral, performance, behavior)
- Uses neutral language to express views (this may be vs. this is the only way) (they may have thought because vs. they were wrong)

11-Intellectual Humility

Sounds like:

- Requesting explanations/ clarifications/understandings
- Students self-monitor: What do I need? What am I missing?
- Can I explain this to someone else? We have different answers to this problem? Why?
- Rethinking my position—"Now that I think about it"… or "After what he/she said I would change my position to…"

Looks like:

- Identifying misconceptions and seeking to resolve
- K-W-L (teacher prompts)

- Identifying limitations/bias of text (narration/POV/subjectivity)
- Gap analysis (teachers)
- Students: What part of the process don't I understand?
- What do I need to enhance knowledge?
- (Going back into notes/directions/processes from past experience and using them to help move forward.)
- Revision that reflects new understanding/thinking

12-Intellectual Courage

Sounds like:

- In my opinion, _____, because of_____.
- I understand ____, but isn't it also true that _____?
- Discussion w/differing points of view

Looks like:

- Debate (logical-ethical-emotional) on an issue
- Ability to defend own argument/ another's argument
- Understanding and addressing counterargument in writing or discussion.
- Deconstruction of unsubstantiated myth/stereotype/belief

13-Intellectual Empathy

Sounds like:

- What I'm hearing you say is . . . (and those types of statements)
- If I start your method (use your strategy), I'll need to . . .
- I may disagree, but I understand that your view is based on . . .
- I will make this adjustment to address my audience (or peers) in the best way.

Looks like:

- Reenactments,
- Role-Playing (business scenario, resume from employers perspective, characters, historical people, etc.).

14-Intellectual Integrity

Sounds like:

- My work would be better if . . .
- The concept that my POV ignores is . .
- I need to work on . . .

Looks like:

- Formulating one's argument for a debate.
- Reflecting on own work before submission, just as in peer review.
- Peer review being extended to oneself.
  Self-assessment and reflection.

15-Intellectual Perseverance

Sounds like…

- I was so frustrated last night I started cry when trying to find sources (spent 1.5 hours trying) so I came in for some help today rather than quitting.
- I get this but I don't get this part (b/c it is so complex)
- Discussion that becomes and argument on a complex task… they

	stop and then realize they need assistance and seek it (from peers or adults) Looks like: • Student came in that morning asking for help rather than keeping quiet and quitting. • Goes and asks for feedback (e-mail, extra help, calls a peer) and uses it to continue to move forward and do better or improve upon a task after doing or starting. • Math problem/Essay that student initially does not seem to know what to do but rather than do nothing attempts to reorder the problem or represent the problem in another format to move ahead and see if an insight comes from taking first steps.
16-Confidence in Reason	Sounds like: • I want you to go back to our process, notes, example and evaluate your own work. • Is this good/correct vs. I think this is correct because I applied appropriate evaluative criteria. Looks like: • Takes an exemplar and uses it to evaluate their own or peers work • Self checks work on a math problem or looks at an answer and realizes it can't be right and goes back and revises. • Goes back to the data in a science experiment and verifies that conclusions used the data to prove conclusions. • Develops a persuasive essay using evidence to support reasoning. • Can use oppositions argument and can provide evidence to show why that argument is wrong/flawed. (Can also appear in debates)
17-Intellectual Autonomy	Looks like: • "Independent try" after lesson: individual reflection on what worked & what didn't work • Research: source evaluation/gap analysis: what is still missing? • Evaluation of materials for appropriateness/depth/credibility • Group project reflection: what worked & what didn't/rejected vs. accepted "best practice/evaluation of others' contributions • Analysis of media (SS-propaganda/ ELA-argument & advertisement) Sounds like: • Evaluation of other students' presentations • Comparing alternative pathways for solving a problem/applying a skill or strategy
18-Insight into egocentricity	Looks like: • Evaluation of motives (e.g., world leaders, politicians, artists, the media, etc.) • Identify self-centered behavior in self & others/discuss impacts on

	others • Analysis of characters in literature/ tragic hero • Media studies • Implications of egocentrism on society • Self/group reflection: Recognition of self-serving tendencies & their impact Sound like: • Discussions about motives listed above • This character's/person's flaws cause_____ • Role play
20-Skills in the art of studying & learning	Looks like: • Book talks & conferencing • Applying a thinking model (e.g., decision making, research protocol, scientific method, mathematics formulae) to an original idea. • Developing an original thesis statement for a written assignment/ paper • Applications of concepts of one content area to others/reality Sounds like: • "I thought this passage was important because_____" • "Within-about-beyond connections/ interpretation…" • "I think the writer meant to…" • "Isn't this just like…?" • "When I need to_____, I can use_____" "So that's why _____ happens!"
21-Skills in asking essential questions	Looks like: • Self/peer assessment • Creation/design of study questions/ tests/assessment rubrics • Creation of hypothesis for experimentation • Peer review/revision • Determining and evaluating purpose of writer/lesson/etc. • Reciprocal teaching • Quiz/test analysis & correction • Designing broad research questions and then specific research questions that provide specific approaches to a complex, broad question. Sounds like: • "How does this concept connect to others?" • Students question how an idea/ concept will help to deepen their thinking & knowledge • What else can I do with my data? • What don't I know? What am I missing? How do I fill in the gaps?
22-Skills in the art of close	

reading

Sounds like:

- This author's POV is (same/different) than the other author as evidenced by . . .
- I want to go back to the section about . . .
- The main idea is . . .
- The purpose of the text is . . .
- After reading, the thoughts/questions I have are . . .
- I wonder if . . . (author means, if the author considered, so-and-so would agree)

Looks like:

- Note taking, underlining, margin writing (meaningful, synthesis)
- Identifying genre, author's purpose, POV for the reason of adjusting reading approach
- Preliminary reading
- Rereading with specific purpose
- Discussion/conversation/debate
- Identifying flaws/inconsistencies/ omissions

23-Skills in the art of substantive writing

Sounds (reads) like:

- Would it be more meaningful if I used "_____"
- I organized this way because . . .
- My purpose was . . .
- My evidence is . . .
- Does this make sense?
- Have I supported my thinking?
- Where will this idea fit best?
- How can I say this in my own words?

Looks like:

- Notes have questions, graphic organizers, a system
- Rereading & rewriting—visible rethinking
- Leaving discarded ideas—evidence of process
  Revision & editing(insofar as punctuation impacts meaning)

25-Skills in detecting media bias and propaganda in news

Sounds like:

- Did people really believe this story, this picture (historical example)
- I was watching Fox News or CNBC and they said …. but I was talking to my parents and they said… or you said in class … Who is right?
- When we saw Al Gore's *Inconvenient Truth* it said but when I was watching the news it said….
- Why is the top story yesterday Haiti and today it's Tiger Woods?

Looks like:

- News stories that present statistics in a fashion that supports one perspective… (Wall Street bonuses… The average bonus for Goldman Sachs was $888,000 this year)
- Why is that story leading the news tonight and what is the point or influence such a story has… (Taxation of executive bonuses—Economic hard times vs. 2002 when same story was reported w/ how this helps boost real estate prices and purchases in NYC area)
- Why was the top story Tiger Woods on the same day as NY voted down Marriage Equality?
- This can be a specific subject area discussion or it can also be a side discussion (teachable moment) when kids ask a question.
- WWII or Revolution or a story of an American journalist captured in North Korea—Perspectives—stories presented from both sides.
- State of the Union speech—Fox poll says 80% says it was awful and MSNBC poll says 90% says it was an epic speech. Why?

Curriculum Vitae
Jeffery D. Rieck

Education:

EdD. Walden University Emphasis: Teacher Leadership 2012
Masters Education- Emphasis: Social Studies. 2002
Bachelor of Art – History 1995

Professional Teaching Experience: 18 years

11th grade Regents American Studies teacher 1999, 2012
8th grade social studies teacher 2003 to present
7th grade social studies teacher 2000 – 2005
7th grade English/social studies teacher 1998, 2000-2003
10th grade Regents Global history teacher 1999
6th grade English/social studies teacher 1995-1998

Professional Organizations:

United Federation of Teachers
National Education Association
National Council for Social Studies
New York Council for Social Studies
Colorado Council for Social Studies
Westchester Council for Social Studies
Association for Supervision and Curriculum Development
Colorado Teaching Certification
New York State Permanent Teacher License
National Board Certified Teacher