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Examining Cognitive Presence and Assessment for Learning in an Asynchronous History Discussion

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Abstract

Online learning, which began in the area of tertiary and adult learning and professional development, has been spreading rapidly as an alternative way for students to pursue learning in the K-12 sector. While adult learners may be expected to be more experienced students and cope with the variations in the implementation of online learning, younger K-12 students need a more structured approach to organize their online learning experiences. Formative assessment has been promoted as a means of enhancing all learning, including online learning. This study explored the use of the formative assessment process in the design and facilitation of an asynchronous discussion among high school students. The community of inquiry model provided a lens for the evaluation of the learners' experiences, and students' cognitive presence was assessed in this quasi experimental study. The study addressed whether implementation of an assessment for learning approach in the design and facilitation of an asynchronous discussion would result in significant differences in cognitive presence messages. Content analysis was used to classify discussants' statements according to levels of cognitive presence. Chi-squared analysis was performed to determine independence among levels of cognitive presence and assessment for learning. The findings indicated that there was a significant relationship between the incidence of different levels of cognitive presence statements and assessment for learning. The findings also suggest a way to empower K-12 online learners to play a more significant role in their learning and make their experiences more impactful. However, study with more diverse populations and incorporating measures of achievement is recommended.

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Dedication

This work is dedicated to my family Paula, Cameron, and Camilla.

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Thank you to my family both immediate and extended. Their support has made this journey possible. They all made sacrifices as my time was shared with my work on this paper. They all offered support and words of encouragement that made all the difference when the road ahead looked daunting. Additionally, they were there to cheer me on and prod me to celebrate small milestones. Those celebrations helped me continue on through numerous rewrites and revisions.

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Introduction

Researchers have recently reported significant growth in online learning among younger students (Allen & Seaman, 2013; Picciano & Seaman, 2009). Picciano and Seaman, for instance, projected that 90% of U.S. school districts would offer online courses by 2012. The rapid growth of online learning among younger learners has been accompanied by researchers' focus on the effectiveness of online learning, online pedagogical practices, attempts to form learning communities, and efforts to generate effective feedback for students. Some researchers (Baker, 2011; Borup, Graham, & Davies, 2013; Garthwait, 2014; Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013; Kazu & Demirkol, 2014; Kerr, 2011; McFarlane, 2013; Ozyurt & Ozyurt, 2013; Zhang, 2013) have noted deficiencies in online learning as it exists among younger learners. After studying online learning and Web 2.0 technology use, Baker (2011) and Jimoyiannis, Tsiotakis, Roussinos, and Siorenta (2013) observed that there was a need to make adjustments to pedagogical approaches in the online space. Garthwait (2014) and Ozyurt and Ozyurt (2011) noted that students tended to lose focus when engaging with online resources and veered off-topic when engaging in online discussions. In his study, Zhang (2013) observed superficial engagement with learning activities among elementary and middle school students. Kazul and Demirkol (2014), Kerr (2011), and McFarlane (2011) identified problems with the delivery of feedback that reduced its effectiveness. McFarlane also observed a detachment among online students, which was echoed by researchers' calls for the enhancement of learner-learner interactions in the online space

of both younger and adult learners (Borup, Graham, & Davies, 2013; Clarke, 2012). These shortcomings are concerning because of the growth of online learning (Picciano & Seaman 2009) and the need for its expansion among rural populations as a result of shrinking budgets and teacher shortages (Garthwait, 2014). A pedagogical approach that jointly addresses the generation of feedback, the formation of community, and the cognitive engagement of students is one way to address these shortcomings.

Research conducted by Black and Wiliam (1998) indicated that designing instruction in accordance with the formative assessment process increases student achievement more than any other, similarly purposed initiative. In online learning, formative assessment/assessment for learning has been linked with increased student motivation, reflection, feedback, and achievement. Gikandi, Morrow, and Davis (2011), Glassmeyer (2011), Hodgson (2012), Jacoby (2014), MaClean (2013), Vonderwell (2007; 2013), and Wang (2007) all found positive impacts associated with practicing online assessment for learning. However, the literature is confined to examining isolated elements of the assessment for learning process, such as feedback or self-regulation. A systematic application of assessment for learning, as a process, has not been examined.

Assessment for learning scholars (Black & Wiliam, 1998; Heritage, 2007; Moss & Brookhart, 2009; Popham, 2008; Torrance & Pryor, 2001) have all referred to assessment for learning as a process with interrelated and complementary elements. These elements are reported to have a positive relationship with student learning (Black & Wiliam, 1998). Assessment for learning scholars have postulated that the elements in the process are related and complementary. However, studies to date regarding online

implementation of assessment for learning have focused on applications of individual elements of the process. Therefore, there is a need to study the application of the entire process in the online environment and report on the relationship, if any, between assessment for learning and students' learning.

Most studies of the implementation of assessment for learning in online education have focused on its application with adult learners. However, the National Educational Technology Plan (USDE, 2010) noted that there was significant growth in the use of online learning in the K-12 environment. Picciano and Seaman (2009) surveyed 867 U.S. public school districts. The results from their survey indicated that 75% of the school districts utilized either online or hybrid learning. An additional 15% of districts planned to introduce online or blended learning within three years. Allen and Seaman (2013) reported that 32% of all students were taking at least one online class in 2012. Given the fact that younger learners may not be as experienced or accomplished as adult learners, it is important to examine the role of assessment for learning and the use of online pedagogical practices with this population. Rice (2006) examined distance education among K-12 learners and found a need for research into assessment practices and strategies for enhancing student learning and achievement within that population. Other researchers also have called for research into online pedagogical practices. In concluding their study of online and blended learning, Kazu and Demirkol (2014) called for research into strategies to promote adequate and effective feedback and interaction. Given that asynchronous discussions are used as a means of assessment, Kerr (2011) noted that there was a need for additional research into the use of asynchronous discussions among

secondary students. A similar call was made by Borup, Graham, and Davies (2013), who studied students' interactions with peers, instructors, and content in virtual high schools.

Problem Statement

Research surrounding online learning among younger students indicates that there is a need for approaches to instruction that enhance learning (Baker, 2011; Borup, Graham, & Davies, 2013; Clarke, 2012; Garthwait, 2014; Jimoyiannis et al., 2013; Kazul & Demirkol, 2014; Kerr 2011; McFarlane, 2011; Ozyurt & Ozyurt, 2011; Zhang, 2013). Assessment for learning is one approach that research has shown may improve engagement and learning (Gikandi, Morrow, & Davis, 2011; Glassmeyer, 2011; Hodgson, 2012; Jacoby, 2014; MaClean, 2013; Vonderwell, 2007, 2013; Wang, 2007). It seems that an assessment for learning approach may address some of the problems in online learning among younger students. However, it is not known how to combine assessment for learning and online learning. Research into assessment for learning has not focused on a comprehensive implementation of the process. Also, approaches to enhancing online learning among younger students have only focused on factors that are aspects of the assessment for learning process, such as the provision of feedback (Hodgson & Pang, 2012; Hung, Lin, & Hwang, 2010; Hwang & Chang, 2010; Kibble, Johnson, Khalil, Nelson, Riggs, Borrero, & Payer, 2014; Lawton, Vye, Bransford, Sanders, Richey, French, & Stephens, 2012; Voelkel, 2013; Weurlander, Soderberg, Scheja, Hult, & Wernerson, 2012). Researchers have not addressed how the full implementation of the assessment for learning process would impact students' learning in

the online space. The findings of this study will inform the practice of online assessment for learning in the context of high school students' cognitive presence in discussions.

Purpose Statement

The purpose of this study was to determine whether there is a relationship between cognitive presence, as described in the community of inquiry model (Garrison, Anderson, & Archer, 2000), and the application of the attributes of the assessment for learning process in the design and facilitation of an asynchronous discussion. I facilitated separate asynchronous discussions in two high school Modern World History classes. One class served as a treatment group and the other a control group. Each group participated in two discussions, which I recorded. I then analyzed transcripts from all of the discussions using coding schemes developed by Shea et al. (2010) for the purposes of classifying cognitive presence and teaching presence. I manipulated data yielded from the content analysis as pre- and posttest observations of students' cognitive presence. During the initial discussions, there were no overt efforts on the parts of the teachers to use or implement attributes of the assessment for learning process. During the second discussions the teacher in the treatment class incorporated attributes of the assessment for learning process. I compared and analyzed (at the sentence level) discussion transcripts from both to identify and gauge the incidence of cognitive presence statements and indications of teaching presence.

Research Questions

I hypothesized that there is a positive relationship between the application of an assessment for learning approach in the design and facilitation of asynchronous history

discussions among high school students and the levels of cognitive presence evidenced in the transcripts of those discussions. I used content analysis, a common approach to determining levels of cognitive presence in online discussions, to analyze discussion transcripts from both classes. Analysis of the first discussions yielded baseline data on cognitive presence which I compared with data from the second discussions.

The study was guided by one main research question and two sets of subquestions. Answers to each set of subquestions facilitated testing of a respective set of null hypotheses.

RQ: Does implementation of an assessment for learning approach in the design and facilitation of an asynchronous discussion result in significant differences in cognitive presence messages among high school students during the asynchronous discussions?

H_{01}: There is no significant difference in cognitive messages during the asynchronous discussions.

H_{a1}: There is a significant difference in cognitive messages during the asynchronous discussions.

SQ1: When instruction does not include assessment for learning, what levels of cognitive presence messages are evident?

SQ2: When assessment for learning is applied, what levels of cognitive presence messages are evident?

SQ3: What change in teachers' teaching presence is evident during the asynchronous discussions?

SQ4: What relationship exists between changes in teaching presence and cognitive presence between the asynchronous discussions within each group?

H_{01}: There is no relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

H_{a1}: There is a positive relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

H_{a2}: There is a negative relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

These research questions helped me focus attention on identifying and analyzing the level of cognitive presence in students' posts. I was able to determine students' progression of learning during the discussions by examining the different levels of cognitive presence evident in the discussion transcripts. Akyol and Garrison (2011) noted that there were four progressive stages in the process of cognitive presence: a triggering event, exploration, integration, and resolution. These levels do not reflect achievement of a particular target, but highlight the evolution of a student's process of learning with respect to a particular objective. The hypothesis that I tested in this study was that when assessment for learning is implemented in the design and facilitation of an asynchronous discussion, there is a significant increase in cognitive presence.

At least three aspects of this study shared the process of learning or knowledge construction as a core orientation. Cognitive presence is part of the community of inquiry model and the assessment for learning process which both focus on the processes involved when students learn and teachers teach. The data yielded from this study was

analyzed using content analysis. Content analysis also focuses on the process of learning as opposed to achievement targets. In this study, I viewed students' learning in an asynchronous discussion from a perspective that focuses on the processes they follow to develop their understanding around a specific objective, cognitive presence (Garrison et al., 2000). The students in the treatment course were exposed to instruction in keeping with the attributes of assessment for learning in order to enhance cognitive presence by improving the processes students follow as they learn (Black & Wiliam, 1998). An analytical approach that focuses on students' learning processes, content analysis (Henri, 1992; Akyol, Garrison, & Ozden, 2009), was employed to code and facilitate the analysis of data before and after the application of the assessment for learning process.

During the study, discussion posts from one Modern World History section were analyzed. Identifying marks were removed to protect students' identities. Instruction leading up to the first discussion did not include any specific attempt by teachers to implement an assessment for learning approach in the design and facilitation of the discussion. This does not mean that the teacher did not utilize any of the attributes of the assessment for learning process. Teachers involved in the study were trained, experienced teachers who follow overarching guidelines about the design of their instruction. Aspects of the assessment for learning process are part of those guidelines, though the process as a unitary approach is not. Teachers in the study received professional development on the assessment for learning process and were coached by a professional instructional coach who has in depth knowledge of the process. The second discussion featured a deliberate attempt to implement the assessment for learning process in the design and facilitation of

the discussion. Content analysis of the discussion posts revealed whether the level of cognitive presence was more evident when the assessment for learning approach was used.

Altogether, data from the content analysis enhanced understanding of the role of the assessment for learning process in the design and facilitation of an asynchronous discussion. Assessment for learning, the community of inquiry model, and content analysis are all focused on the process of learning more than the product of that learning. This alignment of focus benefitted this study because it facilitated a fidelity of purpose. Testing for the relationship between cognitive presence and the implementation of the assessment for learning process complemented a focus on the different levels of cognitive presence indicative of students' growth within their understanding of the topic.

Theoretical Framework

Paradigm/Worldview

Constructivism provided a paradigmatic frame for unifying the theoretical and conceptual frameworks that guided this study. Specifically, the works of Dewey and Vygotsky provided me social constructivist frameworks that I used to conjoin the theory of formative assessment with the community of inquiry model. While there are many forms of constructivist thinking and even various emphases within the social constructivist interpretation of constructivism, the work of Dewey and Vygotsky provided the best constructivist frameworks for this study.

Monism. Dewey (1938) and Vygotsky (Vygotsky, 1934/2012) rejected a dualist view of human learning. This point was critical to the framework for this study. By

rejecting the dualist view and promoting a monist interpretation, Dewey and Vygotsky suggested that it is not appropriate to conceptualize learning as either the interjection of some external piece of content or the revelation of what students already have within them. Instead, learning happens when students interact with content. Dewey highlighted this when he explained that learners need "periods of genuine reflection" (p. 46) but also require the aid of teachers and peers to contribute towards experiences that reflect the "principle of continuity of experience" (p. 21). In other words, Dewey is noting that the learner does reflect and make connections between content and his or her own experiences, but there is also a role for external forces to guide the learner into experiences that will support future growth.

A premise of this study was that while external influences like a teacher may impact learners, learning is developmental as students interact with externalities, reflect, and then act. In his analysis of Vygotsky's ideas on interaction and learning, Wertsch (2008) explained that Vygotsky was stating that there are both intra-psychological and external factors at work during students' learning. Vygotsky (Vygotsky, 1934/2012) explained that growth in a child should be viewed as developmental with each new stage building upon the previous (p. 132). Wertsch (2008) has interpreted Vygotsky's work on learning to mean that Vygotsky was not just concerned with the acquisition of language but the act of communication and the reflection that it prompts in the mind of a learner (p. 68). Vygotsky noted that at an early age children expressed egocentrism through gestures and signs (p. 29). He suggested that the egocentric speech was in fact evidence of

children thinking about the problems they faced and was developmental in nature because it was followed by the emergence of inner speech (p. 242).

The developmental nature of children's learning is exemplified by Vygtosky's concept of the zone of proximal development (Vygotsky, 1934/2012). The zone of proximal development is a characterization of a two way communicative experience that exists between student and teacher, or, as Vygotsky explains it, "the cooperation of the child with adults" (p. 206). That interaction moves the student towards progressively higher functioning because the teacher guides, the student reflects, and then acts. It is this interaction between teacher and learner that moves students' understanding forward. In this study, I assumed that taking away either of these two critical factors stops learning. Russel (1993) pointed this out in his comparison of Dewey and Vygotsky when he noted that the both scholars suggested that it was interaction between student and teacher that developed learning, not the existence of two extreme and distinct elements of content and learner.

A monist perspective was critical to this study because my study was predicated on the idea that interaction among learner, peers, and teacher is where learning occurs. I focused on what learners, peers, and teachers do to inform whether or not learning is enhanced by a particular approach. Both formative assessment and the community of inquiry model assume that learning is the product of interaction among learner, peers, and teacher. Dewey's and Vygotsky's rejections of a dualist perspective and their embrace of a monist perspective set the stage for my use of formative assessment and the community of inquiry model to analyze and explain the learning interactions that occurred in my

study. Given that monist perspective, it is worthwhile to examine what Dewey's and Vygotsky's ideas say about the roles of teachers, students, and peers.

Teachers. Teachers have a unique and important role in students' learning according to both Dewey and Vygotsky. Dewey (1938) used an interesting term to describe the nature of educative experiences, "connectedness in growth" (p. 56). Dewey noted that it is only those experiences that promote future growth that are in fact educative. A person has many experiences during a lifetime. Some experiences are negative and may encourage individuals to pursue destructive paths. From the multitude of types of experiences that a person may have, some have the potential to lead to future experiences that promote healthy growth and the development of mind. Connectedness in growth inheres in these strings of experiences. The essential question for the design of educative experiences thus becomes, "How does a learner gravitate towards the right types of experiences, if he or she does not have the knowledge or awareness to seek and select the right experiences?" This is where the teacher plays a critical role. Through a superior knowledge of content and a greater breadth and depth of experience, the teacher guides the learner into the types of experiences that promote further growth. This is the long view that Dewey discussed when he explained that unlike other professions, the work of the teacher is expected to perpetuate beyond the point of contact. The successful teacher facilitates learning and helps the student learn how to learn.

In his analysis of Vygotsky's ideas, Wertsch (2008) concluded that adults use communication and directions that may be just beyond the ability of children to comprehend. However, they often follow up these efforts with some type of action that

prompts the right action on the part of children. Wertsch uses the term “luring” (p. 78) to show how the adult scaffolds the experience to be always just beyond comprehension to encourage the child to move to a new plateau of understanding. The adult provides both the direct communication or “other-regulation” (Wertsch, 2008, p. 66) and the prompt for the child to understand the correct next move as well context for understanding what the direct communication may have meant. The adult helps the child select experiences that will move them forward while fostering communicative tools that will be useful for the child to continue learning. In this way, both Vygotsky and Dewey saw the role of the adult as facilitating experiences that promote understanding but also help the learner to develop the capacity to become self-regulated. Formative assessment and the community of inquiry model both feature similar roles for teachers. In them, teachers are instructional leaders that guide students as they develop understanding and capacity to become self-directed learners.

Learners. Learners have a central role in their own development and growth. During the journey of education, the teacher is the guide providing useful information about the road ahead. However, the learner is the navigator and driver. The learner makes connections between the teacher’s input and his or her experience of the road to chart a successful way forward that leads to the predetermined destination. In his discussion of purpose, Dewey (1938) noted that purpose was different from desire. Desire is what might innately exist in the learner. This impulse may lead the learner to explore what is currently known and experience what is currently available.

Such experiences, Dewey noted, are not educative because they do not lead to progressively more complex and useful experiences (p. 12). Input from the teacher provides the signal for the learner to build upon what is currently known or experienced, and the learner leverages that input to move to more complex experiences. In other words, the learner must connect the dots and act upon them. Dewey explained that desire may be sterile without a plan to execute some action towards attaining goals. It is the learner who must take in the suggested goals of the teacher, and integrate those with his or her own experiences to move forward. Formative assessment and the community of inquiry model also include a role for the learner that mirrors what Dewey advocated.

Wertsch's (2008) discussion of language games between mothers and children and Morrissey's (2009) study of pretend play between mothers and children were both focused on the role of students within the zone of proximal development. The zone of proximal development is that range of activities that stretch the capacity of the learner to facilitate learning and development. In both cases, the authors discussed how adults provided scaffolding to children. During the games, adults do not provide solutions for the children because if they did so, there would be no point to the game. Instead, adults provide input for children to make connections and arrive at the desired behavior.

Both Wertsch (2008) and Morrissey (2009) demonstrated how children make the connections that moved their learning forward. Wertsch explained that the movement from one zone to another was the product of the child attempting to bridge the gap between what they know and the input given by the adult (p. 78). The role of the learner is to take the input provided by the adult and connect it to what they know in order to

make progress towards a predetermined goal. Learners are therefore active participants in their own learning. Morrissey concluded that in the pretend play activities studied, the children who demonstrated the greatest learning were the ones who took the most responsibility to engage in the play activity. Conversely, those children's parents reduced their provision of scaffolding to facilitate their children's learning and development. Learners' active participation within Vygotsky's zone of proximal development is similar to the role they must play in the formative assessment process and within the community of inquiry model.

Socialization. Peers also play an important role in the process of learning. That role is similar to the role played by teachers, but limited by the capacity of peers. In his discussion of social control, Dewey (1938) noted that peers often exercise a socializing function in groups. Peers agree upon the parameters of their knowledge and jointly move towards the goals as they understand them. The teacher generally sets the rules which are adopted by learners and used to guide interaction among learners. In his examples, Dewey suggested that learners are willing to take direction from peers as long as that direction seems to align with what the agreed upon rules are thought to be. As the teacher provides instruction and guidance, learners take what the teacher offers and apply it to their own situation. As they interact with peers, learners rely on their understanding of what the teacher has offered to inform their communication with peers. The same is seen in the formative assessment process and the community of inquiry model. Peers play a significant role that relies upon what each of them got from their interactions with the teacher and other peers.

Vygotsky's ideas reveal a similar perspective. Wertsch (2008) explained that Vygotsky believed that development began on the inter-psychological plane or with social interaction. While Vygotsky's focus was on the relationship between adult and child, it did not preclude the involvement of peers who possess superior knowledge. In fact, Vygotsky's zone of proximal development is predicated upon the idea that the person doing the scaffolding does so because he or she has superior knowledge and is able to contribute something that can help the less developed or less knowledgeable individual. The zone of proximal development would work as well for peer interaction if such interaction was based upon the guidance of an expert such as the teacher. In both the formative assessment process and the community of inquiry model, the role of the peer is that of a proxy for the teacher in certain situations. Feedback given from peer to peer that is based on the guidance and instruction of the teacher is likely to help learners progress between the zones of proximal development.

Formative Assessment

Assessment for learning is also called formative assessment. Research conducted by Black and Wiliam (1998) indicated that designing instruction in accordance with the formative assessment/assessment for learning process increases student achievement more than any other, similarly purposed initiative. The authors explained that the process must include attributes such as (a) providing learning goals and success criteria, (b) using probing questioning techniques, (c) providing descriptive feedback, and (d) encouraging self reflection all within a collaborative climate. Similar to the ideas of Dewey and Vygotsky, the process functions as a learning experience where peers and teachers play

an important role as learners interact with content, peers, and teachers. In the following subsections, I introduce the process of formative assessment and discuss alignment with the social constructivist ideas of Dewey and Vygotsky.

Definitions. I used the terms *formative assessment* and *assessment for learning* interchangeably in this study. The abbreviation, AfL, was used in tables and figures to refer to assessment for learning. The Formative Assessment for Students and Teachers convened by the Council of Chiefs of States Schools' has defined formative assessment (CCSSO, 2008) as "a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes" (p. 5).

Twenty-five state representatives to CCSSO accepted the definition (CCSSO, 2008). FAST SCASS has also identified five attributes of formative assessment. They include (a) awareness of learning progressions, (b) provision of learning goals and success criteria, (c) provision of descriptive feedback, (d) incorporation of self and peer assessment, (e) existence of a collaborative climate (CCSSO, 2008)

The definition includes two very important elements. First, formative assessment is a process. In education today formative assessment is often seen simply as a problem of getting technology, like student response systems or QR codes, to facilitate polling students and providing feedback (Waters, 2012). However, this definition indicates that formative assessment is a structured, multi-stage, ongoing activity and distinguishes it from a test item. Also, it mentions that both teacher and students are players in this process. It is not a way for teachers to organize instruction in order to facilitate student

mastery of specific content. Instead it is an interactive collaboration among students and teacher that aims to develop learning and increase achievement.

Social constructivist underpinning. The attributes that comprise formative assessment are similar to some of the operating procedures of Bloom's (1968) mastery learning. However, the unique social constructivist underpinnings of formative assessment are most clearly seen when it is compared to mastery learning. Bloom called for formative evaluation that chunks content into manageable bites of content. While this seems similar to learning progressions, it reflects a cognitivist focus on providing appropriate content. Learning progressions prepare teachers for understanding what students may be thinking in order to engage them in their own learning. Mastery learning also features the absence of grades for formative tests. However, the purpose is to allow teachers to see where students went wrong so that they can adjust their instruction. Formative assessment precludes the assignment of grades because it anticipates interaction between both teacher and student during the lesson. Mastery learning sets as an aim students' improvement with respect to a specific piece of content as well as the enhanced independence of the learner. However, it seeks to achieve this largely through the efforts of alternative instructional strategies. Formative assessment sets the same aim, but it focuses on empowering students to interact with teachers and content as they take responsibility for their learning. As Black and Wiliam (2001) noted, it is the responsibility of both students and teachers to make adjustments in the formative assessment process.

Community of Inquiry

The community of inquiry model is a framework for understanding and analyzing the interactions that occur within online learning communities or classes. The model describes the interaction of teachers and students as teaching presence, social presence, and cognitive presence. The attributes of the formative assessment process spell out actions that promote teaching, social, and cognitive presence. Together, they are linked with the formative assessment process providing a blueprint for achieving a community of inquiry (see Table 1).

Table 1.

Formative Assessment Attributes/CoI Elements Alignment

Formative Assessment Attributes	**Community of Inquiry Model Elements**
Awareness of Learning Progressions	Teaching Presence
Setting Learning Goals and Success Criteria	Teaching Presence
Using Probing Questioning Techniques	Teaching Presence
Providing Descriptive Feedback	Teaching, Social, & Cognitive Presence
Encouraging Self Reflection	Cognitive Presence
Creating a Collaborative Climate	Teaching, Social, & Cognitive Presence

Definition. Garrison, Anderson, and Archer (2000) described the community of inquiry framework as a learning experience that comprises interactions between teachers and students that produces a teaching, social, and cognitive presence. Each presence is a

type of behavior that flows from the roles teachers and students perform within the community. Garrison et al. went on to describe each presence and give indicators of what might exemplify each presence. Each presence supports and influences the others and allows for the development of a rich experience that could not happen if any of the presences were to be lacking.

Teaching presence. Teaching presence is the behavior performed by the teacher in the community. Garrison et al. (2000) defined it as the "design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile outcomes" (p. 32). Garrison et al. (2000) and Shea et al. (2010) have identified three types of functions that exemplify teaching presence: instructional design, facilitation of productive discourse, and direct instruction. Shea et al. went on to identify other functions such as assessment. There are certain activities that characterize each function such as organizing course materials, setting learning goals, engaging students with questions and feedback to keep them motivated, and diagnosing and responding to students' misconceptions (Akyol, Garrison, & Ozden, 2009). These activities are the same functions teachers are expected to perform during the formative assessment process. The activities also align with the types of activities Dewey (1938) suggested should be the roles of teachers as more experienced guides in the learning experience. Vygotsky also described a similar role for the adult who sets a task at the upper limit of the child's zone of proximal development, prompts the child to act, and observes the child's actions with the intention of determining what type of assistance

could be rendered to help the child breach the upper limit of the zone of proximal development.

Social presence. Garrison (2007) described social presence as "the ability to project one's self and establish personal and purposeful relationships" (p. 63). Students and the teacher collaborate to create social presence. Two aspects of this description are worth attention. First, social presence includes the establishment of personal relationships. This aspect of social presence can be seen in two of the three types of behavior that comprise social presence: affective expression and group cohesion (Akyol et al., 2009). Affective expressions involve the personal connection involved in getting to know members of the community. Group cohesion involves rituals such as using names and referring to group members in an inclusive, collective manner. Second, social presence involves purposeful relationships. Purposeful relationships align with the third type of social presence behavior identified by Akyol et al. (2009). Purposeful relationships are exemplified by open communication, reflection, and participation. This aspect of social presence is related to the reasons for the community's existence, education, and learning. In the formative assessment process, teacher and students must act within a collaborative climate. The purpose of this climate is to facilitate the type of behaviors exemplified by social presence. Dewey (1938) also described a cohesive group where students felt safe to participate. He suggested that freedom for the student meant being part of a class where they felt safe to explore and contribute. Also, the zone of proximal development is really a relationship between adult and child that fosters familiarity and makes it safe for the child to try until he or she achieves success.

Cognitive presence. Garrison (2007) defined cognitive presence as "the exploration, construction, resolution and confirmation of understanding through collaboration and reflection in a community of inquiry" (p. 65). It is important to note that cognitive presence is the process of thinking that yields deeper understanding. Garrison argued that an examination of discussion transcripts could yield evidence of a student's thinking processes which may indicate that he or she is on the path to learning. Examination of transcripts may reveal the four stages (Appendix D) in the process of cognitive presence: triggering event, exploration, integration, and resolution (Akyol & Garrison, 2011). The triggering event is related to a student becoming aware of a particular problem that may be posed as part of an assignment or question. During the exploration stage of cognitive presence, the student may restate the problem, understand the nature of the problem, and search for appropriate input. The integration stage is characterized by the students connecting the problem to their own knowledge in an appropriate manner. The final stage, resolution, signifies that the student is able to solve the problem, solve a similar problem, or is ready to move on to a new challenge. Cognitive presence is an iterative process that takes the learner closer to understanding. This is what is required as part of the formative assessment process. Students must engage with content and reflect upon feedback and instruction to move learning forward. In Dewey's and Vygotsky's notions of learning, students or children also progress iteratively from awareness to comprehension which shows an internalization of the experience or message.

The social constructivist ideas of Dewey and Vygotsky provide a theoretical context for my use of the community of inquiry model to examine and analyze online learning interactions. The community of inquiry model spells out roles and functions for teachers and learners that promote purposeful communication and learning within the community. The formative assessment process is a blueprint for action that can operationalize the community of inquiry model. The attributes align with teaching, social, or cognitive presence. The table in Appendix A illustrates the relationship among the Deweyan and Vygotskian paradigmatic ideas, the community of inquiry model, and the formative assessment process.

Nature of the Study

In this study, I utilized a quasi-experimental design to study cognitive presence when asynchronous discussions are designed and facilitated according to an assessment for learning approach. The dependent variable, cognitive presence is a component of the community of inquiry model (Garrison et al. 2000). I introduce the independent variable, assessment for learning (CCSSO, 2008), in the design and facilitation of an asynchronous discussion. Altogether, discussants in two separate classes engaged in their respective threads for approximately five weeks. The control class participated in discussions that had been designed and facilitated without implementing the assessment for learning process. The treatment class also participated in two discussions, but their second discussion was designed and facilitated in keeping with the assessment for learning process. I analyzed transcripts for teaching presence between the first and second

discussions for both teachers to determine the change, if any, in the design and facilitation of the discussions.

A quasi-experimental design was appropriate in this case because ethical, practical, and legal constraints make experiments difficult to conduct in social settings, especially when behaviors are being observed (Kirk, 2013; Steiner, Wroblewski, & Cook, 2009). A strict experimental design was not appropriate for this study because, as Frankfort-Nachmias and Nachmias (2008) have noted, time interval, degree of specificity, nature of groups, and time sequence of events are all factors that could confound an attempt to use an experimental design in this study. In the interest of minimizing the disruption to participants' daily routine within the school, an approach that used existing groups of students and teachers was necessary. Also, observation and measurement of students' behaviors are not easily and conclusively attributable to intervening factors. For these reasons I used a quasi-experimental design for this study.

Operational Definitions

I used the terms *formative assessment* (Black & Wiliam, 1998) and *assessment for learning* (CCSSO, 2008) interchangeably in this study. The Council of Chiefs of States Schools' Officers group on the formative assessment for students and teachers has developed a widely accepted definition of formative assessment. According to this group, formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes (CCSSO, 2008). The community of inquiry model is a framework that incorporates the three elements of social presence,

teacher presence, and cognitive presence to foster collaborative learning experiences that result in deep learning (Garrison, Anderson, & Archer, 2000). Each element interacts with the other two to create the conditions for collaborative and engaged learning.

In this study, I examined threaded discussions. Threaded discussions are computer-mediated discussions that occur remotely over an extended time. Specifically, I examined assessment-for-learning-designed threaded discussions and traditional threaded discussions. For this study, *traditional threaded discussions* are discussions that are designed and facilitated in any way that does not comply with the assessment for learning process. While some attributes of assessment for learning may exist in the traditionally designed threaded discussion, the theory of assessment for learning describes the entire process being applied not a piecemeal approach.

Assumptions

The teachers in this study were faculty in a small virtual charter school. While I recruited the participants from a pool of experienced and certified brick and mortar public school teachers, the small sample size means that the teachers may not be representative of most public school teachers. I assumed that the teachers were not already practicing the online assessment for learning process in its entirety. However, it was likely that, as experienced teachers, they did utilize some of the attributes. I also assumed that the assessment for learning professional development provided to the teachers would help them gain a reasonable level of proficiency with respect to implementing the process. Additionally, the transcript analysis/grading stage of the study relied on the learning

management system's capability to store and export discussion transcripts in a readable format for examination.

Scope and Delimitations

Much of the research on the use of threaded discussion in online learning has focused on adult learners. Because there is relatively little research on the use of threaded discussion with adolescents, I focused on high school students to explore the use of asynchronous discussions among that group. The population for this study comprised students in a small brick and mortar charter school. These students had not been exposed to fully online learning. Given the characteristics of the population for this study, it cannot be assumed that the findings from this study will be applicable to younger elementary school students or students in fully online high schools.

Limitations

The generalizability of this study is limited by the fact that it was focused on high school students who were instructed by teachers in a blended learning environment. These students are part of a brick and mortar charter school and were not accustomed to learning with the threaded discussion tool. It is reasonable to assume that their use of this tool may have been less sophisticated than that of students in fully online environments. Therefore, my findings may not be generalizable to students in fully online schools.

I also used a small sample size. The school that was the context for this study did not have more than 120 Modern World History students available for study. The result was a small sample size of ≤ 30 discussants in both the treatment or control groups.

Significance

In this study, I aimed to fill a gap in scholarly knowledge regarding the utilization of asynchronous discussions among high school students. I also sought to implement the assessment for learning process (CCSSO, 2008). Indeed, a comprehensive implementation of the process was an important feature of this study because the literature on assessment for learning does not include many incidences where the process was implemented in its totality. I investigated whether utilizing the assessment for learning process enhanced cognitive presence among high school students during asynchronous discussions. This study thus has implications for the practice of instruction and assessment in the rapidly expanding K-12 online learning space (Allen & Seaman, 2013).

Summary

The works of Dewey (1938) and Vygotsky (Vygotsky, 1934/2012) provided a conceptual framework for this study. This social-constructivist underpinning influenced my assumptions, perspectives, and goals in this study. Specifically, it facilitated my study of relationships between variables that describe the interactions among learners and teacher. The assessment for learning process was the independent variable. It provided a framework for designing and managing an educational experience consistent with social constructivist principles. The process required specific attention to the creation of a learning community where learners learn from each other and from reflection. In keeping with a social constructivist perspective, the dependent variable in this study was cognitive presence. Cognitive presence is one part of the community of inquiry model that can be

used to describe interactions among learners within an online learning community. I used content analysis to measure the existence of cognitive presence in the asynchronous discussion. There was a tight alignment among between the conceptual framework, the foundations of the independent variables, and the foundations of the dependent variables. I observed interaction among students and teacher within the context of an asynchronous discussion, a common tool used in online learning and a rich medium for encouraging interaction among learners and content in the online space.

In the next chapter I review seminal and current research into assessment for learning, the community of inquiry model, the effective use of asynchronous discussions, and the assessment of asynchronous discussions. In the seminal research review, I demonstrate a fundamental alignment among the different aspects of this study which kept the study streamlined despite the multifaceted focus. I review current research to explore the existing body of knowledge surrounding each aspect of this study. I also review research on the use of content analysis to identify how I determined the best approach for analyzing the discussion transcript data.

Chapter 2: Literature Review

Introduction

In its report on the growth of online education, the United States Department of Education noted that the K-12 sector was on target to see significant expansion in the use of online educational opportunities (USDE, 2010). Much of the research into online learning has focused on adult learners. In this review I take much of that work into consideration while focusing on research into online learning opportunities in the K-12 sector. Specifically, I focus on asynchronous discussion.

The first two areas of focus in this review are the practices of assessment for learning in both brick and mortar and online institutions, and the community of inquiry model. Articles that I reviewed on the assessment for learning process provided clarity regarding my theoretical underpinning and helped me examine its use in online and brick and mortar institutions. Other articles proved useful because they explained the community of inquiry model and reported on recent findings regarding how the model can be used to provide a perspective on the interactions within the educative online environment.

The third section of this review is focused on asynchronous discussions. These articles showed how participating in an asynchronous discussion affects students with respect to common elements in assessment for learning and the community of inquiry model like reflection, self-regulation, community, and cognition. Finally, in the last section of the review, I discuss literature on assessing asynchronous discussions. Since

content analysis is often used to analyze asynchronous discussions, I reviewed research into content analysis.

Throughout this review I pay particular attention to what has been reported in the literature about the process of students' knowledge construction so that an assessment for learning approach can be tested, examined, and analyzed. Assessment for learning, the community of inquiry model, and content analysis all focus on the process of students' knowledge acquisition. Together they provide a unifying theme in this project. Assessment for learning provides a way to structure educative processes, the community of inquiry model provides a perspective to interpret interactions within those processes, and content analysis serves as a tool for assessing discussion transcripts in a way that illuminates the different stages of knowledge construction.

Literature Search

I conducted an electronic search of the following five databases: Education Search Complete, ERIC, ProQuest Central, PsycINFO, and SAGE Journals. The terms I used in searches were various combinations of *assessment for learning, online learning, online assessment, online discussion, online cognitive development, high-school asynchronous discussions, assessing asynchronous discussions, online history discussions, online formative assessment, hybrid learning, formative assessment, asynchronous discussions, threaded discussions, community of inquiry, cognitive presence, motivation, self-directed learning, experimental research, social research, quasi-experimental design, research design,* and *content analysis*. My inclusion criteria were that the articles had to address the use of assessment for learning, asynchronous

discussions, and research design approaches appropriate for studying educational strategies. These searches yielded many articles, 86 of which I used for this literature review. The articles included seminal works published as early as 1992, to more current studies published in 2014. I also used Google Scholar to identify relevant articles, and followed its "cited by" for search results indicating articles that were cited in many other studies.

Formative Assessment Theory

Background

In offering a theory of formative assessment, Black and Wiliam (2009) linked formative assessment to Vygotsky's zone of proximal development. They claimed that the zone of proximal development is not just a statement about the extremes of a student's capabilities, that is, what they can do on their own without assistance. Instead, they noted that the zone of proximal development is the area where, through the experience of cognitive dissonance, the provision of feedback, and the practice of metacognition, students learn. In other words, the zone of proximal development facilitates a process of growth in a student's knowledge.

Black and Wiliam (2009) also noted that, when crafting and managing the learning experience, the teacher attempts to ascertain what the students are thinking, not just whether or not they have the right answers. Knowledge of the student's thinking influences the type of feedback that is given to the student and helps the teacher provide a cognitive challenge that encourages the student to connect the dots and move forward. These experiences are, in Dewey's words "educative" (Dewey, 1938, p.12). Though the

purpose of formative assessment is to increase achievement, one of the outputs is a student's increased ability for self-direction.

Black and Wiliam (2001) explained that when formative assessment is practiced, students engage in metacognition and develop the skill of learning how to learn. Each of the attributes of the formative process plays a part in developing the metacognitive skills of students. If any of the attributes were to be omitted, the process would be lacking. Teachers' understanding of the learning progressions allows them to predict students' possible "steps and missteps" (Moss & Brookhart, 2009, p. 24) as they attempt to achieve a learning goal. When teachers are aware of these pitfalls, they can better understand student's thinking and provide appropriate feedback which is critical for encouraging metacognition. Linked to the provision of descriptive feedback is the attribute that encourages self- and peer-assessment. When students receive descriptive feedback, they are then poised to reflect on or assess their work vis a vis the learning goals.

In the following sections, I examine formative assessment as a theoretical construct, review seminal works to explore the relationship among its attributes, and explore its use in the field as well as its potential for enhancing asynchronous discussions. First, I review the literature to clarify the meaning of the terms *formative assessment* and *assessment for learning*, identify what the literature says are critical activities required as part of the process, and examine what the theory states about the need for these activities to be applied together. The work of the FAST SCASS and Paul Black and Dylan Wiliam served as the primary sources for this exploration. In the next section, I review the perspectives Paul Black and Dylan Wiliam and FAST SCASS

regarding the nature of assessment for learning, and its capacity to facilitate an examination of the efficacy of utilizing the attributes in concert with one another. This is necessary because I make the point that studies of formative assessment have primarily focused on the application of individual attributes of formative assessment. I review the seminal works of Black and Wiliam (1998; 2006), Hattie and Timperley (2007), Pryor and Torrance (1998), and Brookhart, Zientarski, and Walsh (2006) for this purpose. In the third section, I explore current research into the practice of assessment for learning in the field among online students. Next I discuss, an alignment between assessment for learning and the community of inquiry model as evidenced in the literature. Specifically, I focus on the intersection of the community of inquiry model and the assessment for learning process related to the constructs of reflection, self-regulation, community, and cognitive presence. Across this review, I address the impact of formative assessment on threaded discussions and rely on the community of inquiry model to clarify that relationship.

Nature of Formative Assessment

In 2006, a subset group from states belonging to the Council of Chief State School Officers (CCSSO) began focusing on formative assessment. This subgroup, called Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards (FAST SCASS) has done work researching formative assessment as implemented in various states. FAST SCASS has worked with scholars in the assessment field including Dylan Wiliam, James Popham, Susan Brookhart, and Rick Stiggins to formulate and refine ideas reflected in various publications, and conduct its work under

the guidance of its collaborative advisor, Margaret Heritage. FAST SCASS developed the definition of formative assessment that I used for this study. According to the group, "Formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes" (CCSSO, 2008).

However, in order to provide a clear sense of the nature of formative assessment, here I examine work done on formative assessment prior to the FAST SCASS and align it to the recent FAST SCASS work. This is necessary because researchers (Clark, 2010; Heritage, 2010; Herman, Osmundson, & Silver, 2010; Kingston & Nash, 2011; McMillan, Cohen, Abrams, Cauley, Pannozzo, & Hearn 2010; Pachler, Daly, Mor, & Mellar 2010;) have alluded to confusion that exists in terms of the definition, characteristics, or parameters of formative assessment or assessment for learning. I contend that though slight differences in language may be evident between FAST SCASS and Black and Wiliam (1998), there is a consistency with respect to what constitutes the practice of formative assessment.

Scriven's (1966) early use of the term formative evaluation bears some similarity to its use in current research. Later work, especially the work of Black and Wiliam (1998), infused the term with a theoretical underpinning and develop it within a fairly rigid framework. In their seminal work, Black and Wiliam (1998) sought to answer three basic questions.

- Is there evidence that improving formative assessment raises standards?
- Is there evidence that there is room for improvement?

- Is there evidence about how to improve formative assessment? (p. 2)

In order to address these questions, Black and Wiliam conducted a meta-analysis of studies focusing on various initiatives aimed at increasing achieving standards. They then compared the effect sizes of the various initiatives and determined that formative assessment had a significantly larger effect on student learning than similarly purposed initiatives. The researchers reviewed 250 articles spanning nine years and found that formative assessment had an effect size of between .4 and .7. Hu (2010) explained that an effect size of between .5 and .8 represents a medium to large degree of association between two variables, in this case formative assessment and learning. Black and Wiliam's results indicated that formative assessment has the potential for an appreciable to large association with students' learning. These findings seemed to answer the first question about whether formative assessment raises standards (Black & Wiliam, 1998).

Black and Wiliam (1998) also cited literature that identified problems with the practice of assessment. These problems included the provision of ineffective feedback, the negative impact of grading policies that actually served to decrease student effort, and the focus of feedback on issues not directly related to standards and curriculum. In reviewing the literature, Black and Wiliam also found that there were definite areas in common practice that offered opportunities for improving formative assessment. These areas were related to the provision of effective feedback that was linked to the task being attempted and that provided the opportunity for students to vigorously engage in the process of their own learning. The researchers saw this as the need to encourage students' meta-cognition. Students' meta-cognition would result in useful self-assessment,

especially when students had a good idea of the task to be performed or the learning goal. Finally, Black and Wiliam also noted that there was a need for teachers' questioning to be improved to probe deeper into students' understanding and for the wait time to be lengthened to allow students time to self assess.

Black and Wiliam's (1998) conclusions could only serve as notice that formative assessment had promise as an addition to teachers' repertoire of instructional moves and students' involvement in their own learning. However, aspects of the researchers' methodologies and findings have been critiqued in an effort to demonstrate a need for further research. Kingston and Nash (2011), in response to Black and Wiliam, conducted their own meta analysis, and their findings challenged those of Black and Wiliam. Kingston and Nash set out with the specific aim of quantifying the impact of formative assessment on student achievement. They concluded that the actual effect size was more in the range of .25 and that it varied according to the subject under consideration.

Kingston and Nash focused their review on three research questions.

1. What is the average effect size of formative assessment on educational achievement?
2. Is the average effect size of formative assessment on educational achievement moderated by grade or content area?
3. Is the average effect size of formative assessment on educational achievement moderated by specific formative assessment practices? (Kingston & Nash, 2011)

One major criticism of Black and Wiliam (1998) laid by Kingston and Nash (2011) was that Black and Wiliam included studies listed as formative assessment studies

that in fact varied in terms of their implementation of formative assessment. In their effort to quantify the impact formative assessment, Kingston and Nash selected only those studies that stated they were formative assessment studies. Research question 3 helped to guide this by focusing attention on "formative assessment practices" (p. 29). Black and Wiliam in aiming to summarize the state of formative assessment in the field acknowledged that there simply were instances of formative assessment type activities or attributes of the process (CCSSO, 2008) being undertaken. However, their work also acknowledged that all aspects of the process needed to be in place in order for the full benefit of formative assessment to be realized. Utilizing individual attributes like providing feedback or establishing learning goals did not constitute an application of formative assessment. Their examination of underlying research helped to support the fact that many of the practices were formative in nature and that these practices contributed towards raising student achievement. FAST SCASS (CCSSO, 2008) also stated that formative assessment is a process that included various practices or attributes. Both FAST SCASS and Black and Wiliam noted that there were many instances where it has been claimed that formative assessment was being practiced, when in fact it may not be. In exploring the underlying research around feedback, self assessment, questioning, and motivation, Black and Wiliam places the focus on the likely benefits of the process. By focusing only on studies that acknowledge the use of formative assessment, Kingston and Nash excluded studies where formative assessment practices may have been incorporated but may have been going by a different term. By relying on the definition of formative assessment offered by FAST SCASS and the identified attributes, this study

aimed to examine formative assessment from a perspective of common, core attributes and criteria.

Using the Attributes

The FAST SCASS and Black and Wiliam (2009) offer similar perspectives on what formative assessment is and what constitutes its implementation. While there may be differences in terms, the nature of the construct is the same. The FAST SCASS (CCSSO, 2008; CCSSO, 2012) expands on the definition of formative assessment by describing six attributes that are critical to the implementation of formative assessment in classrooms. These attributes were developed out of the inaugural work of the FAST SCASS Formative Assessment Advisory Group in 2006. The group comprised 60 representatives from 25 states including education researchers, Dylan Wiliam, Lorrie Shepard, James Popham, Rick Stiggins, and Margaret Heritage (CCSSO, 2008; Popham, 2008). Black and Wiliam (2009) identified five strategies that help to operationalize formative assessment in classrooms. Both attributes and strategies can be aligned to demonstrate that the construct as expounded by Black and Wiliam and FAST SCASS is the same.

The FAST SCASS (CCSSO, 2008) explained that the attributes are strategies that can be implemented during instruction and that they comprise a process. This view of the practice of formative assessment echoes a similarly expounded view by Black and Wiliam (2009) that formative assessment is not a pedagogy but is actually a set of strategies are useful for the "creation of and capitalization upon of moments of contingency" (p. 10). Both the FAST SCASS and Black and Wiliam are talking about

strategies that complement each other and enhance instruction regardless of the guiding pedagogy. While formative assessment may be a collection of strategies, they achieve coherence when used together as a means to track student learning, estimate the effectiveness of instruction, engage students in activities that guide their learning, and point ways forward to continue effective teaching and learning (Black et al., 2004; Black & Wiliam, 2009; CCSSO, 2008).

The six attributes of formative assessment described by the FAST SCASS (CCSSO, 2008; CCSSO, 2012) are learning progressions, learning goals and success criteria, evidence of learning, descriptive feedback, self and peer assessment, and collaboration. The five strategies offered by Black and Wiliam (2009) that help practitioners operationalize formative assessment are clarifying and sharing learning intentions and criteria for success, engineering classroom activities that elicit evidence of students' learning, providing descriptive feedback, engaging students to function as learning resources for their peers, and engaging students to function as learning resources for themselves (Black & Wiliam, 2009, p. 8). The attributes and strategies overlap in meaning and address the same types of behaviors as ways to practice formative assessment.

Learning progressions relate to teachers considering the way skills build in a particular subject area when they plan their lessons. This allows the teacher to anticipate some points along a student's progression to mastery where he or she may encounter difficulty. When describing learning goals and success criteria, FAST SCASS explained that for this attribute, teachers must do two things. They must communicate the learning

relevance or goal of the lesson or activity, and they must ensure that students are able to judge for themselves whether they have approached success. Teachers do this by providing statements, descriptions, or engage in discussions that enable students' understanding of the learning goal. Both FAST SCASS and Black and Wiliam stress that this activity goes beyond simply stating standards or objectives. The language used must be intelligible to students and students must understand it in their own terms. This is necessary because Black and Wiliam (2009) explained that students refer to learning goals and success criteria as they reflect upon what they are to achieve. They utilize metacognition as they compare their current position vis a vis the learning goal. As students aim to participate in monitoring their own learning, there must be some criteria by which they can measure their progress. Teachers provide success criteria like rubrics to demonstrate to the students what they will be able to do once they have mastered the concept or skill.

Providing descriptive feedback is a critical attribute of formative assessment. FAST SCASS (CCSSO, 2008) explained that feedback that can be used to move learning forward must address the learning goal, provide information to the student that clarifies exactly where the student's work product is in relation to the learning goal, and offer next steps to improve the work product. The feedback does not focus on characteristics of the student nor does it attempt to rank the student's performance or compare it to other students' work. It provides a road map for the student to follow that will lead to continued improvement and learning. Hattie and Timperley (2007) explained that feedback needed to address three questions, where am I going, how am I going, and

where to next. Feedback aimed at these questions encourages students to reflect and promotes self-regulation. In formative assessment, descriptive feedback is purposed with answering similar questions, where am I now, where am I going, and what do I do next. Descriptive feedback is a critical element in the formative assessment process.

When teachers model providing effective feedback to students, they set the stage for students to engage with their peers as helpful learning resources. FAST SCASS (CCSSO, 2008) noted that self and peer assessment in formative assessment meant students providing feedback to their peers and to themselves (metacognition) that focuses on the task or learning goal. Self and peer assessment should yield the kind of feedback that describes the work product in terms of the learning goal and suggests ways to move forward. Black and Wiliam (2009) noted that self and peer assessment is not about providing grades but rather about helping students develop the skills to move beyond the zone of proximal development. An assessment that moves learning forward would not be possible if teachers had not clearly communicated learning goals and success criteria. Since students should not be expected to know how to give effective feedback, teacher feedback plays an important scaffolding role in students learning of the process of formative assessment. Students who are accustomed to the process are then able to play pivotal roles in their own learning and that of their peers because they can make contributions that actually aid learning. This is why the definition of formative assessment (CCSSO, 2008) states that it is a process involving both teachers and students.

Finally, the creation of a collaborative classroom is also critical to the formative assessment process. In their work on motivation, Brookhart, Walsh, and Zientarsky (2006) explored how students' motivation and volition affected achievement. They noted that students needed to feel that there was a chance and likelihood for them to improve performance, if they were to expend effort. The collaborative climate in the formative assessment process describes an environment where a student's artifact is seen as a work in progress. The feedback does not include grades to shut down the need for further effort. Instead it points the way forward for enhanced performance. The attribute, collaboration, identified by FAST SCASS (CCSSO, 2008) describes a culture in a classroom where students feel that they are participants in the learning process. While aspects of the formative assessment process like questioning and feedback appear to be cognitivist strategies, the notion that students must feel comfortable playing an important role in classroom activities illustrates the social constructivist nature of formative assessment. Formative assessment as described by Black and Wiliam (2009) and FAST SCASS (CCSSO, 2008) is an interactive process that engages students and teachers in roles that focus on moving learning closer towards stated goals.

The strategies identified by Black and Wiliam address the same behaviors as those identified by FAST SCASS (CCSSO, 2008). In their study of the practice of formative assessment Black, Harrison, Lee, Marshall, and Wiliam (2004) observed 24 math and science teachers from six schools in two southern England school districts. The King's-Medway-Oxfordshire Formative Assessment Project (KMOFAP) aimed to revisit the third research question from Black and Wiliam (1998), relating to how to improve

formative assessment. The work produced findings that help to clarify the strategies later stated in Black and Wiliam (2009).

While considering learning progressions is not one of the strategies identified by Black and Wiliam (2009), their work with the KMOFAP suggested that teachers needed to be cognizant of how students learned the particular content. Black et al. (2004) noted that as part of teachers' efforts to provide effective feedback that moved students closer to the learning goal, teachers needed to anticipate what type of feedback would be helpful. Teachers had to craft learning experiences and activities that aligned with how students learned the topic so that they could prepare feedback that would keep students on track and actually help them to move forward. This idea of planning instruction with the learning progression in mind is seen again in the statement that formative assessment is "concerned with the creation of … moments of contingency" (Black & Wiliam, 2009, p. 10).

Another strategy put forward by Black and Wiliam (2009) is providing learning goals and success criteria. The authors describe this in similar terms to the FAST SCASS. Black and Wiliam (1998) lamented the fact that students sometimes do not have a clear picture of what they are trying to achieve during a lesson. This has ramifications for student self assessment and peer assessment. If students do not know what the target is supposed to be, they will not be able to gauge the quality of a work product. Students must have a clear understanding of what is to be achieved. Black and Wiliam (2009) balanced this student centered approach with an acknowledgement that the teacher still plays a leadership role. The researchers echoed Dewey's (1938) ideas when they

explained that the teacher had to be responsible for bringing their content or discipline knowledge to the lesson and assume responsibility for setting goals.

Black et al. (2004) and Black and Wiliam (2009) thoroughly explored the nature of questioning and the elicitation of evidence of students' learning and showed why it was an important part of the formative assessment process. The authors suggested that in order for teachers to provide effective feedback, they must not only know whether students can give the right answers, but they must also understand students' rationale for their answers. This is why Black and Wiliam explained that the purpose of questioning or the elicitation of evidence of learning is to stimulate students' cognition (p. 11). Having asked the probing question, the teacher then allows the student to think deeply about the answer. The result of this type of questioning is better evidence about what students know. In addition, such questioning stimulates the creation of "cognitive conflict" (p. 19). As content leaders in the classroom, teachers use questioning and other methods of elicitation of students' learning to lead students' exploration of content. Creating cognitive conflict encourages students to pay more attention to what they know in an attempt to resolve the conflict. Black et al. noted that in order for questioning to be effective, students had to be afforded longer wait times. This reasoning aligns with the research of Arend (2009) and Baglione and Nastansky (2007) who also claimed that longer wait times in asynchronous discussions produced better responses from students. During the formative assessment process, effective questioning and elicitation of evidence of students' learning stimulates cognition, reveal students' thinking, and so

facilitate the provision of more useful feedback; central to moving students learning forward.

As stated earlier, Black and Wiliam (2009) stressed that formative assessment capitalizes on "moments of contingency" (p. 11) during a lesson. Having observed students' thinking through effective elicitation of evidence of students' learning, the teacher utilizes feedback to address what they learned about the state of students' learning. Black et al. (2004) noted that feedback should address the state of students' learning and should offer next steps to help the student continue learning. Feedback like questioning stimulates cognition and points the way forward. The student should see value in adopting the feedback and will do so provided the opportunity to utilize the feedback is available. For this reason, Black et al. and Black and Wiliam stressed that feedback during the formative assessment process should be descriptive. Providing grades or scores may communicate a finality that students may interpret as rendering further effort futile. Black et al. did not rule out the provision of grades but indicated that grades should be de-emphasized while students are still engaged in developing their learning.

In both Black and Wiliam (2009) and Black et al. (2004), the authors made it clear that the formative assessment process involves the learner as an active participant in the lesson. FAST SCASS also emphasized the role of the student and enshrined that characteristic in the definition where it states that the formative assessment process is practiced by "teachers and students during instruction" (CCSSO, 2008). Black and Wiliam and Black et al. explored the role of the student as a peer and self assessor. The

key aspect of students' involvement as assessors of a work product is that they must assess the work based upon common and necessary criteria. The learning goal and success criteria serve as a beacon to students and help them to assess work in a way that accurately gauges its relation to the content. Therefore, self and peer assessment enables and encourages important metacognitive activity that helps students think about their work, compare it to the goal, and devise strategies to continue working towards that goal. Consequently, a student will not only have the benefit of feedback from the teacher but also from a peer and themselves as they attempt to develop their learning.

Summary

The strategies put forward by Black and Wiliam (2009) and the attributes referenced by FAST SCASS (CCSSO, 2008) both spell out a process that engages teachers and students in a constant assessment of work against a goal and the utilization of feedback to move students' learning towards that goal. The concept of the learning goal and success criteria is critical in terms of the content of the feedback that is provided and the steps that follow from that feedback. A second critical component of the formative assessment process as described by both Black and Wiliam and FAST SCASS is the nature of feedback itself and the way in which it aids students' learning. A third important aspect of the process described by both Black and Wiliam and FAST SCASS is the involvement of the student in the learning process. Each of these three critical components, the learning goal and success criteria, feedback, and the role of the student are supported by scholarly work around formative assessment that serves to clarify why

the process depends on the synergistic relationship of all three (Black et al., 2004; Black & Wiliam, 2009; CCSSO, 2008).

Assessment for Learning in Practice

Recent studies of formative assessment have contributed a lot to the knowledge base surrounding this process. However, these studies (Hodgson and Pang, 2012; Hung, Lin, & Hwang, 2010; Hwang & Chang, 2010; Kibble, Johnson, Khalil, Nelson, Riggs, Borrero, & Payer, 2014; Lawton, Vye, Bransford, Sanders, Richey, French, & Stephens, 2012; Voelkel, 2013; Weurlander, Soderberg, Scheja, Hult, & Wernerson, 2012) have not reported on the full process in practice. These researchers have studied formative assessment with a narrow focus on feedback or assessment. This study's focus was on full implementation of the assessment for learning process and a connection, if any to the processes followed as students learn not the achievement that may be evident as a result of formative assessment.

There is evidence in the literature (Weurlander, et al., 2012) that suggests that formative assessment has a positive impact on student learning. Weurlander et al. explored the ways in which formative assessment could be used as a tool for learning and students' perceptions of the role of formative assessment in their learning. The researchers' grounded theory approach yielded that formative assessment was an important tool for internal and external motivation among students, and that students used feedback to become more aware of the status of their learning. While these findings are promising, the qualitative approach does not provide a way to empirically measure the impact of formative assessment. Students were able to share their experiences of

formative assessment, but the study's treatment of formative assessment was as a test not a process.

Findings from the study by Weurlander et al. (2012) are helpful because they show that students perceive formative assessment as having a positive impact on their learning. However, the convenience sample of nine students interviewed were all medical students enrolled in a pathology course during 2007 and 2008. Reflections from these students could be expected to be more sophisticated than the perceptions of high school students, who were the focus of this study. This is particularly important because the findings suggested that formative assessment was a source of motivation for the students. It is reasonable to assume that motivation among medical students would function differently among medical students as it does among high school students.

Empirical studies (Hung, Lin, & Hwang, 2010; Hwang & Chang, 2010; Lawton, Vye, Bransford, Sanders, Richey, French, & Stephens, 2012) have also found a positive relationship between formative assessment and learning. Findings from these studies demonstrated that feedback was a critical component of student's learning. This was evident in the study of 27 Taiwanese elementary students in grades 5 and 6 by Hung, Lin, and Hwang (2010). The action research project included students reporting findings from ecology observations in e-diaries. The students benefitted from embedded questions and feedback that were deployed on personal digital assistants (PDAs) as formative assessment. The results of the study showed that students' answers on their worksheets were progressively better after receiving formative feedback. This study focused on younger students' achievement. However, the study did not include statistical tests that

would have neutralized the impact of other factors that may account for the student's progress. It also did not offer an explanation for the 20% of students who did not show significant progress on their worksheets.

In a more robust study, Lawton, Vye, Bransford, Sanders, Richey, French, and Stephens (2012) also found that formative feedback had a positive relationship on students' learning. However, this study involved adult students in control and treatment groups of *N*=37 and *N*=38 respectively. Even though the participants were much older than participants in this study, the findings with respect to the positive relationship between formative assessment and learning are still noteworthy. Pre and post tests were administered to both groups. The findings found a significant relationship between scores on the pretest and the posttest. However, even when controlling for this relationship, students in the treatment group scored an average of 5.5 points higher than students in the control group. Also important was the fact that the higher scores for students in the treatment group were more pronounced for students with lower pretest scores. This finding seems to support the contention by Black and Wiliam (1998) that lower achieving students benefit more from formative assessment than high achieving students.

A similar finding for lower achieving students benefitting from formative assessment was found in another study by Hwang and Chang (2010). In an elementary school in Tainan City, Taiwan, 5^{th} grade students were chosen to form a treatment group *N*=29 and a control group *N*=32. The students studied lessons in culture. The treatment group utilized PDAs to receive formative feedback in a system called Formative Assessment-based Mobile Learning (FAMIL). The treatment group received prompts and

hints to seek resources when their answers were not correct. This formative feedback guided them to the right answers as they learned. The pretest showed no significant difference between the two groups (t=1.37, $p > .05$). However, the average post test score of the treatment group was 8 points higher than the control group's scores. Part of this study included a survey to ascertain cognitive load and mental effort, characterized as the effort that results when students are engaged in their zone of proximal development. While lower achieving students in the treatment group also performed better than the lower achieving students in the control group, the study also showed deeper thinking on the part of lower achieving students in the treatment group than lower achieving students in the control group. Though this study seemed to address the process of learning, it only did so indirectly through the results of an examination of students' achievement.

Much of the research around the online implementation of formative assessment seems to focus mostly on the feedback generated out of students' completion of assessment items. The assessment event or items are characterized as the "formative assessments" (Kibble, Johnson, Khalil, Nelson, Riggs, Borrero, & Payer, 2014, p.125). In the study by Kibble et al., the primary characteristic of formative assessment seems to be timing as it is distinguished from summative assessment because it occurs while learning is still ongoing. In that study, the researchers sought to determine whether the positive relationship between students' formative assessment and summative assessment scores were reproducible in an integrated curriculum. A student body of 41 undergraduate learners at the University of Florida were offered (N=12) ungraded quizzes as purely formative exercises. The researchers found a significant correlation between the quizzes

and summative assessments $\rho(39) = 0.39$, $p < .05$ and . $\rho(39) = 0.44$, $p < .01$ for the midterm and final respectively. Kibble et al. also revealed that throughout the course and despite the fact that quizzes did not provide an opportunity for students to add to the course score, participation rates were high with around 80% of students completing quizzes. The researchers reasoned that it was the opportunity for feedback on proficiency for the assessed skills that encouraged students to take the quizzes and that knowledge of weak areas allowed students to close gaps in their understanding before summative assessments.

The conclusions drawn by Kibble at al. (2014) are supported by the findings of Hodgson and Pang (2012). Hodgson and Pang argued that the main purpose of formative assessment was to provide students with an opportunity to judge themselves as learners. The researchers sought to determine through the use of a survey instrument, how students used formative assessment to learn during the 10-week course. Like Kibble et al. and other researchers, Hodgson and Pang saw formative assessment as primarily an assessment event and the feedback that proceeds from the experience. The target of this study was 104 students completing an undergraduate degree in rehabilitation science in Hong Kong. Of those 104 students 51 completed the survey. Altogether 10 tasks were administered as formative assessments over 10 weeks. These tasks were composed of multiple choice questions. The students were surveyed to determine how they used the tasks to learn during the course. Of the 104 students taking the course 93% completed at least 9 tasks, so participation was high. The remaining 7% completed between 6 and 8 tasks. Similar to the conclusions drawn by Kibble et al., 90.2% of the students felt that

the tasks helped them develop a deep understanding of the course material and helped them retain material learned in class. While the study did not attempt to introduce a collaborative environment as a construct to be studied, questions on the survey did address collaboration. Of the 51 students completing the, 70.2% saw the tasks as a means to encourage collaboration. However, only 47% of the students said they regularly interacted with other students over the tasks.

It seems clear that formative assessment helps learning and student performance on summative assessments. It seems likely that when students receive feedback from formative assessment events, they then consult the material to close gaps. A study by Voelkel (2013) demonstrated such. Voelkel also saw formative assessment as an event. In her action research project, she sought to develop weekly online quizzes and evaluate the effectiveness of those quizzes as feedback to a second year undergraduate cohort in biological sciences at the University of Liverpool. The quizzes were offered in 3 cycles between 2008 -2011. The first cycle was voluntary and the last two were compulsory. Summative scores were compared with previous cohorts from 2006 – 2008. In the data collection years cohort sizes were 83, 91, and 78. There researchers found a significant increases in test performance when the students were given formative assessment items. The first year had a low participation rate, but the second year's participation was much higher because the assessments were now compulsory. However, the researchers noted that summative test performance declined in the second year and was at the same level as it was before the start of the project.

The final year of the project saw high participation as well but summative scores rose significantly over the second year score with an effect size of (0.6). During the course of the project the researchers conducted evaluation surveys to inform their modifications. One aspect of the formative assessment events that was changed between the second and final year was the promptness and personal nature of feedback. Survey results from the second year had suggested that students felt that the feedback aspect of the assessment events were less than optimal. The third year survey results indicated that students actually used the feedback to guide their revision of material and close gaps in their understanding.

In studies cited here, formative assessment has been shown to have a positive relationship with achievement and even higher order thinking. This is promising because it suggests that formative assessment, even when it is applied as individual attributes, may improve students' learning. However, much of the research around formative assessment does not have the broad focus on an inclusive process as is proposed in this study.

Generating feedback seems to be the primary focus of existing studies around formative assessment. However, feedback may be made more potent when the environment is collaborative not evaluative. Feedback may also be more helpful when there are clearly established learning goals that guide the nature of feedback. Unfortunately, the focus on feedback in formative assessment studies has led research to attend to the logistical problem of providing feedback to large student bodies (Lawton, D., Vye, N., Bransford, J., Sanders, E., Richey, M., French, D., & Stephens, R., 2012;

Lin, J. & Lai, Y., 2013; Lin, J. & Lai, Y., 2014; Maclean, G. & McKeown, P., 2014; Palmer, E. & Devitt, P., 2014; Voelkel, S., 2013; Vonderwell, S. & Boboc, M., 2013; Zou, X.; Zhang, X., 2013). Each of these articles noted that the logistics of providing feedback was a primary problem affecting the utilization of online formative assessment. In each of these articles formative assessment was treated as a task and the provision of feedback in response to the task naturally appeared to be a major stumbling block. In some instances factors other than feedback that seemed to align with other attributes of the formative process were mentioned, but in no case were all the attributes addressed and they were never addressed as part of instructional episode.

In the study by Lawton et al. (2012), the focus on formative assessment was really a focus on the provision of feedback. In the study it was noted that the rapid growth of online learning was as an opportunity for the workplace and tertiary institutions to enhance the education and professional development of engineers and engineering students by making small changes in the structure of online courses that would facilitate access to feedback while learning. Formative assessment was treated solely as a way to integrate feedback into learning experiences.

Feedback and the problem of providing feedback to large numbers students were also the foci of formative assessment studies by Lin and Lai (2013) and (2014). In the quasi-experimental study by Lin and Lai (2013) three classes taking an international business course in the Ching Yun University were involved in testing the impact of providing feedback to students. The study involved the administration of what was referred to as formative assessment quizzes. The main focus in the study was on finding a

way for students to access feedback and for teachers to manage the provision of large amounts of feedback to students.

In another study, Lin and Lai (2014) treated formative assessment as solely about the provision of feedback and therefore attended to the issue of the logistics of providing feedback to large numbers of students. This quasi-experimental study conducted among third year university students in China involved the administration of formative assessment quizzes. Using Social network awareness, the researchers sought to facilitate connections among students so that those with answers to questions could be easily matched with students who had questions. Since peer feedback was the central feature of this study, it was paramount that there should be a way to encourage students to participate in the peer feedback system. Facilitating connections through the SNAFA was seen as the solution to this problem. Despite the appearance of collaboration, the study again treated formative assessment simply as a problem of feedback that needed to be solved.

Like Lin and Lai (2013), Maclean and McKeown (2014) were concerned with the provision of feedback as the central issue in their formative assessment study. MacLean and McKeown noted that for them the goal of online formative assessment was to provide feedback that moved learning forward. As such, they were concerned with testing an efficient way to ensure student engagement in formative assessment activities and to facilitate the provision of feedback. Maclean and McKeown compared online formative assessment quizzes and take home assignments to see which would provide the best source of feedback as well as help students' learning. The researchers noted that there

were five essential characteristics of formative assessment (p. 246). These characteristics were participation, timeliness, the nature of the feedback being provided, alignment between the formative assessment and planned summative assessment, and cost. While these are all reasonable considerations when administering an assessment, they are not aligned with the concept of formative assessment as a process. In fact, this focus on formative assessment is primarily concerned with the provision of feedback.

While much of the research into online formative assessment seems to treat formative assessment as an event and focus primarily on feedback, formative assessment as a process that involves various parts or attributes has been incorporated into some instructors' practice. In a report on formative assessment techniques, Vonderwell and Boboc (2013) still reference formative assessment as a thing, "techniques" (p. 22), but they also describe these techniques as addressing multiple needs for encouraging learning. Some studies (Palmer & Devitt, 2014; Voelkel, 2013; Vonderwell & Boboc, 2013, Zhou & Zhang, 2013) around formative assessment seem to focus on other attributes besides feedback.

Palmer and Devitt (2014) conducted a quantitative study of medical Year 1 (n=129) and Year 2 (n=130) students over the course of two years. The aim was to examine two approaches to delivering formative assessment quizzes in such a way to maximize student participation and learning. Palmer and Devitt referred to formative assessment as a quiz or assessment activity throughout the study but also referred to formative assessment as a process. The authors acknowledged that collaboration, another aspect of the formative assessment process, would have been a useful student activity but

made no provision for it in their study. Despite acknowledging the process, Palmer and Devitt were chiefly focused on the problem of engaging students and providing feedback to large numbers of students.

Voelkel (2013) completed a three cycle action research project that also acknowledged aspects of the formative assessment process but still only treated formative assessment as a test. The study involved Year 2 students at the University of Liverpool engaged in an animal physiology module. Voelkel identified the problem of low participation and engagement and the need for more effective feedback to students. The purpose of the study was to determine the effectiveness and feasibility of incorporating weekly online formative assessments. Voelkel acknowledged that providing learning goals was critical for learning but mentioned it only in the context of an assessment activity

Self-assessment was the focus of a formative assessment study conducted by Zhou and Zhang (2013). The researchers were concerned with the use made of score reports for English proficiency tests taken by (n=200) students at Chongqing University. The researchers wondered whether a new score report that provided more timely and descriptive feedback would encourage more self-directed learning moves by students. Through interviews the researchers determined that the limited feedback on the traditional reports hindered students' attempts to self-assess but the expanded feedback on the new report facilitated self-assessment and the development of new learning goals. Learning goals and self-assessment are both attributes of the formative assessment process. However, Moss and Brookhart (2009) explained that learning goals are jointly

formed by student and teacher as they plan an approach to a specific lesson. Moss and Brookhart emphasized that the formative assessment process treats learning goals as a developing phenomenon that is addressed as part of instruction. In this study, learning goals were set in response to feedback on a particular assessment event and were the work of individual students in response to that feedback.

While there has been a primary focus on feedback and an acknowledgement of other attributes, some research has suggested that these other factors are required for formative assessment to be more effective (Berridge, Penney, & Wells, 2012; De Kleijn, Boumeester, Ritzen, Ramaekers, & Van Rijen, 2013; Hodgson & Pang, 2012; Horstmanshof & Brownie, 2013; Jacoby, Heugh, Bax, & Bransford-White, 2014; Perera-Diltz & Moe, 2014; Lawton, Vye, Bransford, Sanders, Richey, French, & Stephens, 2012; Lin & Lai, 2013; Lin & Lai, 2013; Maclean & McKeown, 2014; Palmer & Devitt, 2014; Sullivan & Freishtat, 2013). These researchers have noted either that forming a collaborative community, utilizing learning goals, or allowing for self-reflection and self-assessment are important factors that make formative assessment more effective. Each of these factors aligns with the attributes of the formative assessment process (CCSSO, 2008).

Berridge, Penney, and Wells (2012) employed a somewhat narrow focus on formative assessment. Despite citing the works of Black and Wiliam (1998) and Popham (2008) that call for student and teacher engagement in the formative assessment process, the researchers were more focused on students' evaluations of the learning experiences as a means of providing feedback to instructors. The authors reported on a pilot of the

Electronic Formative Assessment of Classroom Teaching eFACT system. Through the eFACT system, students anonymously responded to questions about elements of their class experience that helped or hindered their learning and offered. One emergent theme in students' responses was that a sense of community was lacking as a result of the nature of online learning.

Horstmanshof and Brownie (2013) noted a similar need for a focus on developing a collaborative community in their study of formative assessment. The authors focused attention on the need to develop community and the critical nature of learning goals as well as the importance of feedback. Horstmanshof and Brownie were interested in facilitating the development of academic writing proficiency among undergraduate students at Southern Cross University in Australia. The researchers utilized a discussion board over eight weeks as a space for students to post 500 word posts that could draw feedback from teachers and peers.

The article by Horstmanshof and Brownie (2013) seems to focus on at least four of the attributes of the formative assessment process (learning goals, collaborative community, teacher and peer feedback, and self-assessment) (CCSSO, 2008). In addition to structuring the discussion topics to focus on specific learning goals, the authors also noted that efforts were made to advise students of the benefits of community and collaboration with respect to the discussion. Horstmanshof and Brownie reported that informal feedback from students suggested that they felt the opportunities to focus on the goals in each discussion, receive continuous feedback, and provide and receive peer feedback were beneficial. They also noted that scores on final essays suggested that all

students benefitted from the discussions with weaker essay-writing students benefitting more. This is in keeping with research by Black and Wiliam (1998). However, the researchers did not treat the attributes as part of the formative assessment process but as features of the online discussion forum. This study embraced the nature of discussion forums and attempted to deliberately structure discussions with all attributes of the formative assessment process.

Another study that featured a number of formative assessment attributes was conducted by Sullivan and Freishtat (2013). These researchers studied a hybrid graduate course where four discussions were conducted over a three week period for the purpose of providing formative assessment. Data around students' learning experiences were extracted from reflective journals and two interview sessions at the mid-point and end of the course. Some themes that emerged from analysis of the interview and journal data suggested four attributes were important for using discussions as a means of formative assessment. These were the existence of a collaborative community, the provision of learning goals through a problem-based design, the opportunities for self-assessment and reflection, and the opportunities for feedback.

These works by Sullivan and Freishtat (2013) and Horstmanshof and Brownie (2013) give weight to the notion that formative assessment involves multiple attributes not just feedback. Another important observation that one may notice from reviewing these studies is the fact that asynchronous discussions seem to benefit from incorporating attributes of the formative assessment process.

Despite a general view of formative assessment as a test or event, research into formative assessment has highlighted the need for the incorporation of other factors which happen to be some of the attributes of the formative assessment process (CCSSO, 2008). In addition to works by (Berridge, Penney, & Wells, 2012; Horstmanshof and Brownie, 2013; Sullivan and Freishtat, 2013), other researchers have found that attributes besides feedback are also important. The value of developing a collaborative community was cited by Lin and Lai (2013), (2013) and Hodgson and Pang (2012). Relying on learning goals to guide study was noted as necessary by De Kleijn, Boumeester, Ritzen, Ramaekers, and Van Rijen (2013), Jacoby, Heugh, Bax, and Bransford-White (2014), and Lawton, Vye, Bransford, Sanders, Richey, French, and Stephens (2012). A student-centered approach that results in self-assessment, reflection, and self-regulation was also cited as a necessary component for improving formative assessment by Perera-Diltz and Moe (2014) and Maclean and McKeown (2014).

The research into formative assessment cited here primarily focuses on the logistics of providing feedback. When formative assessment is seen as a test it is natural to focus on managing the occurrence of the event. However, despite this focus, studies have found that other factors are also important when implementing formative assessment. This study extended the knowledge base around online formative assessment by examining the implementation of the entire process. Also, most studies cited here focus on adult learners and achievement. This study focused on adolescents, and their process of learning as indicated by cognitive presence.

Community of Inquiry

The community of inquiry framework is a way to conceptualize and analyze interactions within the online learning environment. Such an analysis would focus on teaching, social, and cognitive presence (Garrison, Anderson, & Archer, 2000). Interaction within the online environment prompts behaviors that can be characterized as the three presences that comprise the characteristics of the conceptual model. Behaviors that can be characterized as teaching, social, and cognitive presence have a synergistic relationship such that each presence influences and impacts the others (Garrison et. al., 2000). The following sections will describe the core components of the model, align the model with the attributes of assessment for learning, discuss the application of the community of inquiry model as it has been used in conjunction with the implementation of asynchronous discussions, and clarify the role it will play in this study as a means of evaluating the impact of utilizing the formative assessment approach with asynchronous discussions.

Core Components

Within the community of inquiry model, teaching presence refers to the provision of direct instruction, the design of learning experiences, the facilitation of learning, and the assessment of learning (Garrison et al., 2000; Shea et al., 2010). Evidence of teaching presence would involve teachers or instructors setting learning goals, providing feedback, and encouraging students to take ownership of their own learning (Akyol, Garrison, & Ozden, 2009). Therefore, even though the online learning environment may be characterized by remoteness or distance between student and teacher, the community of

inquiry model notes that teachers and instructors have definite and distinct responsibilities that establish their roles within the environment.

Social presence refers to the involvement of students within a group of learners and the development of relationships that promote group membership and functioning (Garrison (2007). In the online learning environment, remoteness does not excuse the need for collaboration and cooperative learning activities. Akyol et al. (2009) noted that social presence sets the conditions for collaboration and cooperation among learners. Social presence is established through the communication of names and personal attributes, the cementing of the group around a common objective such as the learning goals of a particular course, and the clear and purposeful communication that enables members of the group to work together (Akyol et al., 2009). Together, students and teacher or instructor combine involvement to create social presence within a community of inquiry. The activities noted as part of teaching presence are the vehicle through which teachers connect with the community. Therefore teaching and social presence are interconnected (Garrison, Cleveland-Innes, & Fung, 2010).

Cognitive presence is the product of students' engaging themselves within the online learning community. This manifests itself in reflective and collaborative activities that facilitate the exploration and construction of knowledge, the resolution of new learning with prior knowledge and the deepening of understanding (Garrison, 2007). Cognitive presence occurs in stages of progressive sophistication (Akyol & Garrison, 2011). From a triggering event where students become aware of content students may progress to an exploration stage where they restate new learning without adding any new

flourish or revelation. The next stages involve students' integrating new learning with prior knowledge and applying their learning to resolve problems (Akyol & Garrison, 2011). Throughout the progression of these stages, the student interacts with material provided and presented by the teacher or instructor and interacts with peers in collaborative and cooperative activities. Therefore, cognitive presence overlaps and interacts with teacher presence and social presence (Garrison, Cleveland-Innes, & Fung, 2010).

The theory of assessment for learning and the community of inquiry model were important to this study because of their complementary relationship. Assessment for learning prescribes certain behaviors as seen in the attributes. It is an independent variable in this study. The community of inquiry model provides a means of evaluating asynchronous discussions by focusing on factors that align with the attributes of assessment for learning. It is useful as a tool to evaluate the impact of assessment for learning on asynchronous discussions and delineates the dependent variable, cognitive presence. Table 2 demonstrates this complementary relationship. (See Table 2).

Table 2

Assessment for learning/CoI Model Alignment

Critical components of Assessment for Learning	Community of Inquiry Model	Alignment
Learning goals	Teacher presence, cognitive presence	The provision of learning goals is a function of teacher presence in online learning. Students' rely on learning goals to drive their cognitive presence.
Feedback	Teacher presence, social presence, cognitive presence	Feedback is provided by teachers and peers and is an important example of teacher and social presence. Cognitive presence is also involved because a student must reflect before constructing peer feedback and when interpreting feedback given to him or her.
Student centered	Teacher presence, cognitive presence	Teacher presence facilitates student centered learning by providing supports like learning goals that help students become independent learners. Cognitive presence is an example of students playing a central role and engaging with the content in a course.

Threaded Discussions and Learning

The literature indicates that asynchronous discussions have the potential for encouraging constructs like reflection, self-regulation, the building of learning

communities, and cognition. There is evidence that the structure and moderation of asynchronous discussions determine the quality of the discourse and whether or not such constructs are encouraged Darabi et al. (2011), Schellens and Valcke (2006), Baglione et. al. (2011), Dennen (2008), and Arend (2009). Assessment for learning can play a role in shaping the structure and moderation of asynchronous discussions, such that they result in discourse that deeply explores content and encourages reflection, self-regulation, the building of learning communities, and cognition. In order to fully understand how assessment for learning can play such a role, there needs to be a more comprehensive look at assessment for learning and the ways in which it is implemented in practice.

As online learning spreads throughout various sections of the education sector, pedagogical practices need to be studied and developed in order to provide an effective and fulfilling experience for learners. Asynchronous discussion is a common instructional practice that online learning providers utilize to create effective learning experiences. Scholars (Andresen 2009; Darabi, Arrastia, Nelson, Cornille, & Liang, 2010; Maurino, Federman, & Greenwald, 2008; Vonderwell, Liang, & Alderman, 2007) have identified asynchronous discussions as an important practice within the suite of online teaching and learning practices. They also call for its study and development in order to make it more effective and reliable with respect to facilitating learning among students.

Discussion is essential to all learning. Andresen (2009) emphasized that discussion is a “critical” (p. 249) aspect of learning for any student. As students navigate their learning path through what Vygotsky termed the zone of proximal development, they rely on input from their surroundings to help them progress from one stage to

another. Wertsch (2008) explained that Vygotsky meant it was not simply the acquisition of language and communicative capabilities that promoted learning, but the act of communicating with others.

In the online environment, discussion takes on a special nature, as it is physically and temporally remote. During the threaded discussion, discussants are not physically in the same space nor do they participate in the discussion at the same time. However, it should not be construed that the threaded discussion is any less essential in promoting learning than a face-to-face discussion. In fact, the unique nature of online discussions makes it all the more important to ensure that discussions are purposefully designed and practiced in a way that promotes learning.

If discussions are to be purposefully designed to promote learning, the attributes of effective discussions must serve as guidelines for key components or behaviors that should be incorporated. Recent works by scholars (Nandi, Hamilton, & Harland, 2012; Persico, Pozzi, & Sarti, 2010) have focused on determining how to evaluate effective asynchronous discussions. A number of factors contribute to making asynchronous discussions effective. Students must be cognitively engaged. Discussion posts must indicate that students are actively thinking about the course and the material. Nandi et al. (2012) found that one behavior that made discussions effective was the fact that students asked a wide range of questions. Questioning is an important aspect of the assessment for learning process. Nandi et al. suggested that students' questioning indicated that they were engaged with the course material and the course overall. Other behaviors that indicated cognitive engagement went beyond helping students find the answers to their

own questions and provided a way to actively engage other students. Nandi et al. found that students providing alternative solutions and sharing personal experiences that connected with the content deepened the thinking around the content being discussed. Persico, Pozzi, & Sarti tested a model for teachers to use as they evaluated asynchronous discussion quality and included cognitive engagement as one of the four dimensions of the model. They noted that students' cognitive engagement often results in the development of learning for the student as well as the learning community. The community of inquiry model (Garrison, Anderson, & Archer, 2000) is a useful tool to evaluate these factors that make discussions effective.

Reflection is another attribute of effective asynchronous discussions. It is closely related to cognitive engagement as an activity contained within that type of behavior. Nandi et al. (2012) observed that students often reflected on their discussion posts and returned to clarify their positions based upon responses they received. The fact that students also provided personal experiences also indicated that they had reflected deeply on the content of the discussion and had taken it out of the abstract context into the practical sphere of reality.

Cognitive engagement and more specifically, reflection are strong indicators of the quality of an asynchronous discussion. However, it must be followed by some type of related action if we are to assume that it has had an impact on the discussant. Nandi et. al (2012) reported that the students in their study sometimes voiced their confusion, asked follow-up questions, clarified their initial comments, and sought alternative solutions to problems emerging in the discussion. These types of self-regulatory behaviors were

valued as evidence of the effectiveness of asynchronous discussions (Nandi et. al, 2012). Therefore, evidence of self-regulation can be considered another attribute of effective asynchronous discussions. Such evidence would indicate that discussants have processed posts and have made adjustments to their own thinking and contributions to either aid learning or at least to respond to colleagues.

Finally, the existence of a learning community is another attribute of effective asynchronous discussions. Nandi et al. (2012) and Persico et al. (2010) acknowledged that the existence of community among discussants is a phenomenon that indicates that the discussion is of high quality. Persico et al. (2010) included community as one of the dimensions of their model for evaluating asynchronous discussions. The purpose was to help teachers determine to what extent students were able to extend their presence into the learning activity. Nandi et al. noted that students answered each other's questions, shared feelings of confusion, volunteered personal connections to the content. These activities suggest that the effective asynchronous discussion featured a community where discussants felt safe exploring the content and collaborating to enhance the learning experience. The effective community in an asynchronous discussion is a learning community.

Reflection, self-regulation, community, and cognitive presence are all attributes that can be found in effective asynchronous discussions. To facilitate the study of how asynchronous discussions can promote learning, it is useful to consider what the literature says about the role of asynchronous discussions through the lens of a model such as the community of inquiry, and a theory of instructional practice like assessment for learning.

Table 3 shows the alignment among these attributes of effective asynchronous discussions, the community of inquiry model, and the assessment for learning theoretical framework. (See Table 3).

Table 3.

Intersection Between Elements of CoI and Assessment for learning

AD, AfL, and CoI Intersection	Community of Inquiry Model	Assessment for Learning
Reflection	During asynchronous discussions, learners demonstrate cognitive presence as they reflect on the teacher presence and social presence of their peers	Asynchronous discussions provide the opportunity for meta-cognition, as learners reflect on what they know and how they know it
Self-Regulation	During asynchronous discussions learners demonstrate cognitive presence as they respond to feedback, the products of teacher and social presence	Asynchronous discussions provide learners with the opportunity to play an active role in managing their learning activities
Community	During asynchronous discussions learners demonstrate social presence through interactions with teacher and peers	Asynchronous discussions provide learners with the opportunity to share and receive peer and teacher feedback
Cognitive Presence	During asynchronous discussions learners demonstrate cognitive presence as they reflect and self-regulate	Asynchronous discussions provide learners with the opportunity to focus on learning goals

Reflection

Asynchronous discussions are those that are conducted among discussants who are temporally and physically remote. Discussants may not feel the same urgency to respond to a comment as if they were engaged in a live, face-to-face discussion. Remoteness offers discussants the time and opportunity for reflection (Arend, 2009; Baglione, Nastanski, & Bowden, 2011; Fleming, 2008). While time and the opportunity to reflect is an important feature of asynchronous discussions, do asynchronous discussions necessarily encourage reflection and promote learning? Arend (2009) noted that there were learning benefits to students when teachers in face-to-face classrooms wait longer for students' responses. Therefore, it could be argued that reflection may facilitate the posting of more thoughtful responses to question prompts as well as to teacher and peer feedback. The community of inquiry model describes that type of reflection as cognitive presence, which promotes learning.

While asynchronous discussions can provide the opportunity for reflection, do students use the time in ways that promote learning? The fact that learners have more time in which to craft a response does not guarantee that they will use that time in ways that promote learning, nor does it provide a framework with which to analyze the potential learning benefit of using asynchronous discussions. How does the availability of reflection time during an asynchronous discussion relate to the promotion of learning? A community of inquiry lens suggests that learning in the online environment would be enhanced when students are engaged and demonstrate cognitive presence (Akyol &

Garrison, 2011; Darabi, Arrastia, Nelsom, Cornille, & Liang, 2010; Garrison, 2007). From a community of inquiry perspective, more thoughtful responses would demonstrate cognitive presence, and an effective asynchronous discussion would be one where students were able to reflect in order to produce such thoughtful responses. This is demonstrated in Archibald's (2010) mixed methods study where he found high correlation among the three presences and noted that students found asynchronous discussions helpful in developing their learning.

Research by Baglione and Nastansky (2007), Arend (2009), and Vonderwell, Alderman, and Liang (2007) support the notion that students utilize asynchronous discussions to reflect and post more thoughtful responses, therefore indicating cognitive presence. In their survey of online instructors, Baglione and Nastansky (2007) reported that the wait time built into asynchronous discussions encouraged students to research, reflect, and produce better responses to fellow discussants. In her study, Arend (2009) also found that the longer wait time provided students with time that they utilized to reflect and generate more responses that demonstrated critical thought.

In a qualitative, grounded theory phase of a larger mixed methods study, Arend (2009) explored the occurrence of critical thought during threaded discussions. Data collected from students and instructors supported the notion that the discussions did encourage critical thinking. Critical thinking was defined as "developing one's own way of thinking about course materials" p. 4. Looking at critical thinking in this way means that Arend also paid attention to students' reflection. Students' interview results indicated that there was a preference for threaded discussions because it removed the urgency of a

required immediate response that is characteristic of synchronous discussions. Students also indicated that the discussion's extended time was used to prepare for posting by conducting research and generating references upon which to base their comments. Instructors also noted that the time frame of threaded discussions facilitated reflection. Instructors' interview responses to revealed that they believed the extended nature of the discussion resulted in posts that indicated students had spent time thinking about their answers, and it yielded a deeper discussion of the topic.

In their case study of the role of threaded discussions as an assessment tool that promotes learning in online environments, Vonderwell, Liang, and Alderman (2007) noted that the structure or threaded nature of online discussions was an important characteristic of threaded discussions. The researchers used structure to refer to the ways in which discussions are organized including the difference between asynchronous discussions and synchronous discussions. Their data included students' perspectives that indicated they had a preference for asynchronous discussions over synchronous discussions because they were able to use the time lag in asynchronous discussions to reflect and craft more thoughtful responses to posts. Indeed, Vonderwell et al.'s data revealed that students believed asynchronous discussions were opportunities for instructors to assess students' understanding of the content as well as their reflection upon the content and discussion as evidenced by their responses.

Self-Regulation

Since threaded discussions facilitate reflection by students, it is worthwhile to consider how students' reflection is related to effective threaded discussions. Reflection

is an aspect of self-regulation. Students must take a look at themselves and their learning in order to make adjustments to their strategies or alter their understanding. Reflection is related to effective threaded discussions because it is an element of self-regulation. Bandura (1991) noted that self-regulation "provided the very basis for purposeful action." (p. 248). An effective threaded discussion not only facilitates reflection but also encourages students to play an active role in that educative experience. According to Bandura, self-regulation comprises three types of cognitive behavior: self-monitoring, self-judgment, and affective self-reaction (1991). Threaded discussions facilitate self-monitoring or reflection. Do threaded discussions also promote self-judgment and affective self-reaction?

Using a community of inquiry lens, one would align self-regulation with cognitive presence. Students who are cognitively engaged in a discussion will reflect, self-assess, and adjust their thinking based upon that assessment. From an assessment for learning perspective, the process is dependent on students' self-regulation. Students are called upon to not only self-assess but to also respond to peer and teacher assessment. The student's response will be an adjustment to or continuation of their learning strategies depending on the information gleaned from self, peer, and teacher assessments.

Threaded discussions facilitate self-judgment. Vonderwell et al (2007) identified structure as a critical characteristic of online discussions. According to Vonderwell et al., the structure of online discussions affected learner autonomy and self-regulation. Data from the researchers' case study indicated that students viewed threaded discussions as being conducive to self-assessment. Participants in the study believed that threaded

discussions allowed them to compare their ideas to others and measure both against the content being studied. Before students added to the discussion threaded, they reflected upon the existing students' and instructor comments. This reflection in turn influenced the nature of their contributions. Vonderwell et al.'s findings also indicated that structure was important to self-regulation because the use of rubrics, the establishment of discussion protocols, and the existence of instructor guidelines helped students assess themselves.

Threaded discussions also facilitate affective self-reaction. Apart from structure, Vonderwell et al. (2007) also identified learner autonomy as an important characteristic of threaded discussions. Participants in the case study indicated that they valued the opportunity to choose topics so that they play an important role in directing their own learning. They also valued the threaded nature of the discussion because the nested orientation meant that various discussions could be taking place at the same time. The view was that threaded discussions were preferred to synchronous discussions because once a point had been dealt with; discussants could grow the topic and explore the concept further. They did this by joining other conversations within the thread instead of continuing to talk about a point that had already been dealt with earlier on in the discussion. By doing this, learners were not only self-assessing but also reacting to what their self-assessment told them about their understanding. Learner autonomy was also an important feature of the threaded discussion because it encouraged students to act upon their meta-cognition. Vonderwell et al. concluded that students utilized metacognition before contributing to discussions.

Bandura's (1991) three components of self-regulation were also evident in the findings of Arend's (2009) study of critical thinking and threaded discussions. Data from Arend's study supported the conclusion that students used the discussions to reflect upon the course materials, compare their own ideas to those of their fellow discussants, and then reexamine their ideas in the light of what they had learned. Though Arend's focus was on the incidence of critical thinking, her findings clearly indicated that in critically thinking during the threaded discussion, students were also self-regulating.

Community

Asynchronous discussions also facilitate the work of communities of learners. In their seminal work, Lave and Wenger (1991) explored the nature of situated learning as a phenomenon that involves more than just practical learning but as a system where learners participate in communities of practice. Communities of practice are the relationships where learning takes place. Wenger (2000) argued that a communities of practice has three basic elements. They include members who share a common goal, the members interact with one another, and they strive for mastery in a common curriculum or body of content. Asynchronous discussions also include these three elements.

The activity of learners in a community of practice is called legitimate peripheral participation. Legitimate peripheral participation provides a lens through which to examine communities of learning in asynchronous discussions. Through the lens of legitimate peripheral participation, the learner participates on the periphery of full understanding because they are still attempting to master the content of the particular community. Interaction among learners and instructors help students develop their

understanding and enhance their knowledge. In their work, Lave and Wenger decried the idea of learning as simply the absorption of content (p. 36). Similarly, they criticized an exclusive reliance on didactic instruction as a way to instill knowledge (p. 74). Instead, Lave and Wenger acknowledged that within the community, interaction and discourse about problems and difficulties are important learning activities. Learners interact with participants with the goal of developing their understanding of particular content. This type of discourse and interaction is similar to what occurs in an asynchronous discussion.

In their book, Lave and Wenger (1991) also explored the structure or relationships within a community of practice. Their examination revealed that the master in apprenticeship systems did not always tell the learner the content but often showed or demonstrated. The master also nurtured the learner's knowledge with appropriate stories and demonstrations of knowledge. In the apprenticeship relationships discussed by Lave and Wenger, the master controlled and facilitated access to learning by the apprentice. They shaped the educative experiences that learners would encounter. These activities of the master are similar to the role of the instructor in asynchronous discussions. The instructor models content mastery by using appropriate language and terminology. He or she maintains a balance of involvement by managing his or her presence (Dennen, 2007; Garrison, 2007) and positioning (Dennen, 2007). Finally, the instructor nurtures the discussion with appropriate feedback.

There is evidence that asynchronous discussions feature the three elements identified by Lave and Wenger (1991) as being basic to communities of practice and they feature the same kind of interactions among learners (legitimate peripheral participants)

and instructors (masters). Lee's and Tsai's qualitative study of knowledge construction among a group of graduate level students focused on the students' sharing and on the construction of knowledge within the community. The discussants had different levels of expertise, but all were learners and not experts in the content of the course. Also, the fact that the discussants were part of a graduate level course suggests that they all had a common set of background knowledge. Hou, Chang, and Sung (2008) studied problem solving among a group of university students engaged in a credit bearing technical course on management information systems. While Hou, Chang, and Sung were more focused on knowledge construction by individuals, participants in the asynchronous discussion still shared that common goal of understanding the content. In both studies, participants perceived the asynchronous discussion as a means to develop their learning.

Lave and Wenger (1991) noted that sharing and collaboration was an important aspect of a community of practice. This sharing and collaboration was evident in Lee and Tsai's (2010) study. Lee and Tsai used content analysis to isolate themes related to the patterns of collaborative knowledge exploration. The researchers defined collaborative knowledge exploration as the collaborative effort to explore and make sense of the content being studied. Lee and Tsai identified four categories of collaborative knowledge exploration behavior. These were elaborating, challenging, correcting, and debating. Each of these categories involved a different kind of communication requiring varying degrees of cognitive load. While there was more communication in categories requiring less cognitive load, it is useful to note that the discussions featured communication in all categories. Discussants would interact with each other and share personal stories as well

as text citations to support their opinions. There were instances in the discussions where text references were inadequate to address real life situations. The sharing of personal stories was particularly important in those situations and supported learning within the community. Interaction was also evident when discussants challenged each other's statements resulting in a rich exchange of ideas.

Another important aspect of a community of practice is the role of the leader or master. Lave and Wenger (1991) argued that the role of the master was not solely to provide didactic instruction but to also enrich the activity within the community of practice. There is evidence in the literature around asynchronous discussions that indicates when the instructor's role actively facilitates learning, the activity within the community is more vibrant and focused on the learning goal. There is also evidence that when the instructor's role is lacking, the quality of the discussion suffers and the discussants may not coalesce into a community of learners.

Unlike much of the literature around asynchronous discussions, Journell's (2008) study of asynchronous discussions was focused on the K-12 environment. Journell's case study involved 13 students from a suburban school district in Virginia that had a reputation for progressive inclusion of technology and high standards. The students were taught by an experienced teacher who had taught the course before. Journell lamented the nature of some history discussions as being one-way conversations between teacher and students. Such conversations were characterized by a teacher initiated question followed by a student response, and then ending with a final teacher assertive comment. Journell noted that in those conversations, there was little opportunity for students to exchange

opinions and support one another as a community of learners. Journell therefore wanted to explore the role of the teacher in facilitating a quality historical discussion. Journell's findings were very informative. Most of the discussions that occurred over a period of five weeks were characterized as being uneven in distribution among discussants and lacking in depth of historical knowledge. The teacher noted that he was disappointed with the activity as it seemed that a community of learners had not formed.

Journell's (2008) data also revealed other interesting aspects of the discussions. The teacher had not given much guidance to the students about the goal or what an appropriate response would look like. Indeed, Journell noticed that the teacher seemed to lose interest as the discussions progressed. However, one discussion did generate vibrant dialogue and the kind of collaboration that one would expect of a community of learners. The instructor designed an activity where the students engaged in a mock debate over slavery and assumed various positions. Students' attempts to defend their positions provided a goal that bound the discussants together. As a result, discussants reflected upon each other's posts, responded with qualifications, and asked questions. According to Journell, facilitating an asynchronous discussion among adolescents required that the teacher play a critical role in facilitating access to the activity in terms of providing details about acceptable levels of participation and encouraging a common goal for the community.

Journell's findings can be juxtaposed with the findings from a study by Grisham and Wolsey (2008). Grisham and Wolsey's (2008) study included 8th grade students from a large working class school district in southern California. The students were engaged in

asynchronous discussions that mimicked an activity that they were already familiar with, literature circles. Therefore, the students understood the goal of the activity and began with that in mind. Grisham and Wolsey also spent time at the outset of the activity explaining their expectations for the discussion with respect to the quality and quantity of posts. Students also created rubrics that helped them evaluate their responses. In contrast to the majority of discussions in the study by Journell (2008), Grisham's and Wolsey's findings indicated that students understood and shared in the goal of the discussion. A comparison between the participants' journal entries and their posts on the discussion board reflected higher quality in the discussion posts. Students stated that they felt responsible for each other and believed they needed to keep abreast of the reading in order to make useful contributions.

According to Lave and Wenger (1991), the master controls and facilitates access to the community of practice. Therefore, the teacher's role in asynchronous discussions is to facilitate the development of a community of learners by setting guidelines for participation, establishing a goal that can be shared by discussants, and participating in a manner that moves the discussion along without it becoming a didactic exercise. This is borne out by the fact that the participation of discussants in Grisham's and Wolsey's study resembles the participation of discussants in the slavery debate in Journell's (2006) study. Asynchronous discussions "call for management, structure, and clearly clarified and articulated expectations" (Rose & Smith, 2007, p. 159). When such instructor guidance is in place, the stage is set for the kind of interaction through the discussion that will facilitate the development of a community of learners.

It would seem then that achieving an effective asynchronous discussion relies on the construction and nurturing of a community of learners. Such a community should provide a space for a focus on learning goals as well a safe place to receive and offer feedback. A community like this is tantamount to the type of collaborative climate that is an attribute of the formative assessment process. Boling and Beatty (2010) conducted a case study that revealed that asynchronous discussions do create such communities. The researchers wanted to explore the role of feedback in a hybrid learning environment much like the context for this study. Boling and Beatty conducted their study among 11th grade Advanced Placement (AP) English students in an urban, northeastern United States high school. The students were from a lower socioeconomic background with 70% Latino being and 30% African American. Of the students engaged in the class, 10 agreed to participate in follow-up interviews that were used to triangulate data. Data collection included classroom observations, notes from discussions with the teacher, discussion transcripts and other shared writing, and the interview transcripts.

The researchers examined the case from a cognitive apprenticeship model framework. This allowed them to pay particular attention to the sociological aspects of the community and its learning. Two of the researchers' findings are pertinent here. First, some feedback was of a personal nature offering praise for effort and encouragement. The researchers posited that though such feedback would not be helpful for students to ascertain where they may need to revise their work, it was helpful in creating a climate where students felt safe enough to share their work and receive feedback for revision. Boling and Beatty (2010) also noted that there was evidence that students used feedback

received to revise their writing and improve their work. When the teacher modeled better ways to provide feedback or structure sentences, the examples were quickly incorporated into future online contributions by students. Examining the interactions of this AP English class through the framework of the cognitive apprenticeship model allowed Boling and Beatty to demonstrate the development and working of a community of practice (Wenger, 2000).

Cognition

The literature cited in the above sections indicates that asynchronous discussions can promote reflection, self-regulation, and collaborative learning. It is reasonable to conclude from these findings that when students participate in asynchronous discussions, the activity requires that they cognitively engage with the content or subject of the discussions. There is evidence in the literature to support such a notion. In her study of assessment strategies for asynchronous discussions, Dennen (2008) noted that requiring students to "read and write multiple messages per week" (p. 209) stimulates cognitive activity. Researchers (Akyol & Garrison, 2011; Arend, 2007; Arend, 2009; Baglione et. al., 2007; Darabi et. al., 2010; Schellens &Valcke, 2006) have explored the nature of learning in asynchronous discussions and found that asynchronous discussions promote cognitive activity. Dennen (2007) and Arend (2009) approached the issue of cognitive activity in asynchronous discussion in search of better assessment strategies. Other researchers, such as Schellens and Valcke (2006), Baglione et. al., and Darabi et. al. (2010) have explored ways to utilize the asynchronous discussions to enhance students' cognitive presence.

In exploring assessment strategies for asynchronous discussions, Dennen (2007) and Arend (2009) both agree that assessment strategies influence student cognition in asynchronous discussions. The way assessment is treated in asynchronous discussions influences the ways that students respond to prompts and the ways instructors engage with discussants. Assessing asynchronous discussions is a complex task that requires an understanding on the part of the instructor and student regarding what is of value in the discussion. Also, it is possible that what is assessed may not be the opportunity or incidence of students cognitively engaging with the content (Dennen, 2007). Adding to the complexity of assessing students' cognitive engagement with content in an asynchronous discussion is the fact that students often tailor their learning strategies to fit the discussion task before them (Arend, 2009).

In her paper on current assessment strategies used with asynchronous discussions and the evidence they provide regarding student learning, Dennen (2007) argued that epistemological perspective plays a critical role in designing assessment strategies for asynchronous discussions. She noted that different ideas about what is of value in an asynchronous discussion may not always lead to the identification of incidents of students' learning.

A product oriented perspective (Dennen, 2007) of the purpose of asynchronous discussions suggests that what is of value is the content of the comments posted by students in a discussion thread. If this is so, some assessment strategies may not adequately gauge the level of cognitive engagement of discussants. Dennen made the point that during a discussion, students read text, other content materials, and other

discussants' posts; write responses that address discussion prompts and other discussants' posts; and engage or reflect on discussion prompts and other discussants' posts in order to craft appropriate responses. A product oriented approach to assessing asynchronous discussions may not always be able to determine whether or not students have cognitively engaged with the content, especially if the target of the assessment is the discussion post itself. In other words, participating in an asynchronous discussion may provide opportunities for cognitive engagement that are not immediately visible to instructors.

Dennen (2007) also noted assessment of asynchronous discussions may rely on a process oriented perspective. Such a perspective acknowledges the importance of interaction among discussants as an important indicator of student cognitive engagement. This perspective is related to a social constructivist orientation to learning. It also aligns well with the formative assessment process. Formative assessment as a process relies on the interaction among learners and teacher around the content and stated learning objectives. A process oriented perspective to assessing asynchronous discussions also aligns well with the community of inquiry framework. The intersection of teacher, cognitive, and community presence is where cognitive engagement takes place. However, a process oriented perspective to assessing student cognition during asynchronous discussions is difficult because it requires the examination of certain hidden units of analysis. Dennen noted that sometimes students post simply for the purpose of acquiring participation grades. Dennen alluded to long posts that included multiple citations and clearly indicated that the student read source material but did not offer much opportunity for conversation and discussion. There may also be quite brief posts that pose provocative

questions that may stimulate cognitive engagement in all discussants. Indeed, Dennen acknowledged that some students may post hardly at all, lurkers. These students may be cognitively engaged due to the fact that they are reading multiple points-of-view about the content but assessing their learning would be quite difficult.

Process and product oriented approaches to assessing cognition in discussants may identify instances where students are cognitively engaged, but both approaches fall short of identifying all instances where discussants are cognitively engaged in an asynchronous discussion. Product oriented approaches encourage teachers to look for artifacts like discussion transcripts to provide information about cognitive engagement and learning. Process oriented approaches reveal that cognitive engagement may at times be hidden and not visible in any artifact produced by the student. Perhaps this suggests that there is intrinsic cognitive value just in participating in asynchronous discussions as Dennen's (2007) comment about requiring students to read and write multiple messages about a specific topic (209) suggests. According to Dennen, the entire discussion is "an artifact of learning" (p. 209). If by its nature, participating in asynchronous discussions provide opportunities for students to be cognitive engaged, it would be useful to examine what the literature says about strategies discussants' used to participate in asynchronous discussions.

Arend (2009) conducted a quantitative study that examined the ways in which students adjusted their learning strategies to different approaches to online assessment. Colorado Community College was selected as the site for the study. It has over 5,000 students and 300 online courses. A student sample n=411 was chosen to receive surveys

about the learning strategies employed for different courses and assessment designs. Only 38% responded, but the respondents compared favorably in demographic structure to the college's population. Also, 51 teachers were surveyed from among the college's faculty. All had at least 13 years college teaching experience and were teaching online for at least three years.

Arend (2009) noted that assessment design influenced students' learning strategies. She suggested that planned assessment gave students an indication of what was important in the course and how they should go about preparing to demonstrate competence. From among the range of possible assessment practices, it would be useful to examine Arend's findings about the ways in which students responded to asynchronous discussions.

Asynchronous discussions were examined as an opportunity for formative assessment. This process oriented approach to assessment was evaluated according to the various feedback loops that existed among teacher and students. Teachers self-reported providing feedback that addressed discussants' misconceptions 86% of the time and over 90% of teachers reported giving feedback based upon discussants' understanding and expression of the content. However, teachers also indicated that they felt that only between 55% and 63% of discussants responded to their feedback by making corrections, seeking clarification, adjusting learning strategies, or exploring the content more critically. Despite the fact that teachers felt their feedback was not incorporated by students into their subsequent posts, that fact does not tell us about the level of cognitive engagement among discussants during the discussions.

To facilitate her study, Arend (2009) provided a taxonomy of learning strategies that suggested various levels of cognitive engagement, though she expressed that the strategies did not form a continuum. Rehearsal, elaboration, organizational, critical think, and metacognitive self-regulation were the five types of learning strategies used to describe the students cognitive engagement practices. Rehearsing involved practices like memorizing material, highlighting content, or taking notes. Elaboration strategies involved paraphrasing, developing analogies, and identifying key words. Organizational strategies involved selecting appropriate information and making connections. Critical thinking strategies involved leveraging prior knowledge, transferring knowledge, and evaluating. Meta-cognitive and self-regulation strategies involved controlling overall cognitive strategies.

Arend's findings indicated that students' use of elaboration and critical thinking strategies were positively related to asynchronous discussions and written papers. When courses used asynchronous discussions more often, there was evidence of students' use of critical thinking and elaboration strategies. This supports Dennen's (2007) assertion that participating in asynchronous discussions requiring students to read and write multiple messages indicates cognitive engagement. The practices included in the elaborating and critical thinking strategies are all practices that would be needed for discussants to actively participate in asynchronous discussions. Paraphrasing and using analogies are useful in communicating ideas to others. Leveraging past knowledge and transferring knowledge are important for students to respond to case scenarios that may be the subject of discussion prompts.

Despite the fact that teachers felt students responded to their feedback only a small majority of the time, students reported that they were engaged with the content during asynchronous discussions in terms of elaboration and critical thinking strategies. This is another indication of the fact that it is difficult to assess learning in asynchronous discussions. However, Arend's (2009) study indicated that students leaned more heavily on elaboration and critical thinking strategies in order to participate in asynchronous discussions. It seems that while it may be difficult to measure learning gains in asynchronous discussions, these discussions definitely encourage students' cognitive engagement.

Baglione, Nastanski, and Bowden (2011) stated that "Online discussions, in and of themselves, do not necessarily promote learning" (p. 110). This seems to contradict Dennen's (2007) conclusion that participating in asynchronous discussions stimulates cognitive engagement. However, Baglione et. al. also acknowledged that "online asynchronous discussion groups have the potential for more sustantative discussions, if appropriate pedagogies are applied" (p. 110). Baglione's et. al.'s findings suggested that online teachers perceived that implementing pedagogies to create learning communities promoted students to "integrate ideas into threaded discussions, often creating new thoughts from current streams" (p. 123). While simply participating in any online asynchronous discussion might not encourage cognitive engagement, the structure of an online asynchronous discussion that encourages the formation of a learning community does.

Baglione et. al. (2011) conducted a survey of 122 online teachers from a sample frame of 303. The teachers were faculty at a southeastern university with nine years experience in offering online courses. The teachers taught approximately 4,000 courses among them. The researchers designed and tested a survey instrument to gauge the teachers' perceptions of the role of five constructs when utilizing asynchronous discussions: providing personal information, providing purpose and goals, setting guidelines with respect to netiquette, managing participation, and providing effective facilitation. Within these five constructs, eleven hypotheses were tested. All hypotheses except hypothesis five were supported from the data collected from the surveys (Appendix C).

Hypothesis one suggested that sharing introductions and personal information among discussants, including the teacher, promoted more vibrant discussion. This was perceived to be so because it helped to foster an atmosphere of trust. The second hypothesis suggested that providing clarification about learning goals and course purpose helped the discussion to be more vibrant than a face-to-face discussion. This was judged to be due to the fact that students' development as effective discussants happens at the same time as their exploration and understanding of the content. The third hypothesis supported the notion that establishing rules of participation, netiquette, enhanced discussion because instructors were able to encourage the development of ideas from among more participants. This idea was connected to hypothesis four which suggested that removing body language and personalities from the discussion, as an online

asynchronous discussion does, helps discussants focus more on the ideas stated in the posts and less on the person making the post.

Hypothesis six suggested teachers believed that carefully crafting questions to match students' level of understanding and scaffolding students to move to higher levels of thinking along Bloom's Taxonomy results in enhanced learning. This hypothesis was supported and suggests that teachers see their roles in the discussion as facilitating learning through academic discourse. Hypothesis seven was related to using debate strategies to stimulate greater participation in discussions. This hypothesis was supported but not to the extent that the researchers expected. Hypothesis eight was related to hypothesis six and suggested that scaffolding students with questions from the lower levels of Bloom's Taxonomy would generate more discussion.

Hypotheses nine, ten, and eleven are related and critically summarize the important findings of this study. They suggested that by actively managing discussions in the beginning of the term to effect the five constructs of providing personal information, providing purpose and goals, setting guidelines with respect to netiquette, managing participation, and providing effective facilitation results in the creation of learning communities among discussants. This conclusion is important because it provides an explanation for the incidence of cognitive presence in academic, asynchronous discussions. The teachers in this study believed that when learning communities are formed, students learn to depend on each other and expect that peers will contribute to the learning effort. As members of the community, each discussant feels obligated to engage

with the content by reading posts, text and course materials, reflecting upon their reading, and contributing to the discussion.

Schellens and Valcke (2006) explored the relationship between asynchronous discussions in computer supported collaborative learning arrangements and knowledge construction at the University of Ghent in Belgium. Their findings align with those of Baglione et. al. (2011) and suggest some important points for structuring asynchronous discussions such that they enhance cognition. Schellens and Valcke operated from a theoretical framework that placed individuals' cognitive engagement in a role that supports knowledge construction in groups. In their perspective, the researchers regarded computer supported collaborative learning as activities where learners build off of each other's contemplation of the content before it is shared with fellow students. The content that is shared then facilitates discussions at a higher level of consideration ex. evaluation and integration of ideas into an existing knowledge base. Like Baglione et. al. Schellens and Valcke seemed to be saying that the collaborative nature of learning as it exists in the asynchronous discussion forum raises the bar in terms of discourse and focus on content, thus enhancing cognition.

Schellens and Valcke (2006) conducted their experimental design study with a sample of 113 discussants from 9 randomly selected groups out of a population of 850 university students. The students participated in discussions around six themes for a semester. The themes were authentic in nature, and the discussion was considered a formal assessment that accounted for 25% of the final mark. The unit of analysis was entire messages posted by discussants and two accepted models for transcript analysis

were used in the study. The main research question was aimed at determining whether the collaborative learning in asynchronous discussions result in task oriented and academic discourse and knowledge construction. Of the six hypotheses, four are particularly important for this review. Hypothesis one postulated that there would be more task oriented than non-task oriented messages in the discussions. Hypothesis four indicated that asynchronous discussions would foster more high levels of knowledge construction than low levels as indicated by both transcript analysis tools. Hypothesis five suggested that more messages indicating high levels of knowledge construction would be evident between the beginning of the semester and the end. Hypothesis six suggested that smaller groups will yield more on task messages and higher levels of knowledge than larger groups.

The findings from Schellens' and Valcke's (2006) study suggest that asynchronous discussions do promote cognitive engagement and that the collaborative nature of the discussion is an important factor. Schellens and Valcke found that over 88% of the messages were task oriented as opposed to less than 12% that were non-task oriented. So, discussants were engaged with the course content being considered. According to the transcript analysis tools being used, the messages were of a higher phase of knowledge construction focused on explaining and evaluating new ideas and theories. The findings regarding hypothesis four shed more light on the quality of the discussions. More messages were based on applying theories and evaluating statements than were focused simply on presenting ideas. In other words, it seemed that the discussants had already completed basic processing of the content before posting to the

discussion. The discussion board was therefore a place for a more advanced consideration of the content.

The findings for hypothesis five in Schellens' and Valcke's (2006) study did not support that idea that there would be more high-level knowledge construction at the end of the course than at the beginning. The findings revealed that there were variations among the different types of messages that could be considered indications of high level knowledge construction as measured by both transcript analysis tools. However, there was not a consistent increase across the board for all types of messages judged to be indicators of higher-level knowledge construction. Finally, the results from the study did indicate that smaller groups were more task oriented and had discussions featuring more messages indicating higher-level knowledge construction. Groups larger than twelve had more difficulty remaining on task and producing messages indicating higher-level knowledge construction.

Certain conclusions can be drawn from Schellens' and Valcke's (2006) study. First, asynchronous discussion fosters cognitive engagement and it does so because of the collaborative nature of the activity. Structuring discussions around authentic tasks or collaborative activities to solve problems may be a useful strategy to use in asynchronous discussions. Second, asynchronous discussions are useful as a forum for discussion around themes after individual discussants have completed some processing of material related to those themes. Third, discussion groups should be kept to less than twelve discussants to facilitate task oriented posting and the posting of messages indicating higher-level knowledge construction.

Darabi, Arrastia, Nelson, Cornille, and Liang (2011) conducted a mixed methods study that produced findings supporting the literature cited thus far in this review. The study was conducted during a semester at what was described as a large North American university. From a population of 99 students enrolled in a particular course, 73 juniors and seniors participated. Darabi et. al. were focused on determining the best strategies to use with asynchronous discussions to maximize cognitive presence among discussants. Again, the idea was that asynchronous discussions promote cognitive engagement, but the strategies used to implement the activity mattered with respect to the level of cognitive engagement of discussants. Darabi et. al. relied on Garrison's et. al. (2000) classification of the phases of students' cognitive presence. The triggering phase is when discussants explore content and make sure that there is agreement on the nature of the content. The exploration phase occurs when discussants align the content with prior knowledge and determine likely applications for the content. During the integration phase, discussants consider the implications of various applications of the content to solve problems. The resolution phase is when discussants actually apply the content to solve problems, evaluate those applications and reform their ideas. These phases suggest an increasing sophistication of discussants' cognitive engagement and a deepening of their learning.

Darabi et. al. (2011) utilized four different strategies in their study. The strategies were all focused on authentic learning situations that required the generation of a solution. Discussants were randomly assigned to various strategies in groups of about six students. The various strategies included a structured approach, a scaffolded approach, a

debate format, and a role-play format. The structured approach involved the posting of various questions designed to move discussants to deeper thought and higher phases of cognitive presence. The scaffolded approach involved a robust role for a facilitator who was charged with encouraging discussants to arrive at a conclusion by posting questions and prompts. The debate approach required discussants to defend a particular randomly assigned position. The role-play format required the discussants to post their comments as if they were certain personalities in the cases being studied.

The findings of Darabi's et. al. (2011) study indicated certain key points. First, the strategy used to organize the asynchronous discussion mattered for the levels of phases of cognitive presence and teacher presence was an important factor during the discussion. While it is clear from the literature that collaboration facilitates cognitive engagement of discussants, the conditions impacting the collaboration among discussants is also important. The structured approach featured questions that were an attempt to guide discussants through thinking about the content from the various phases of cognitive presence. Darabi's et. al. findings indicated that there was strong association with lower level phases such as triggering and exploration but not with higher level phases like integration and resolution. Darabi et. al. attributed this to the fact that there was engagement with the content but not with the community or teacher. In other words, discussants were more focused on answering the questions rather than on negotiating meaning with a teacher or fellow student. In contrast, the scaffolded strategy included the facilitator guiding the discussion towards a resolution and this strategy included posts at all levels of cognitive presence, but this strategy had more posts in the resolution phase

than any other strategy. The debate format had the second highest number of posts in the resolution phase but also had many posts in the exploration and integration phases. The role play format also had posts representing all of the phases but had the most posts in the integration phase.

Darabi's et. al. findings indicate that using different strategies in asynchronous discussions can enhance cognitive presence. A discussion that simply structures the requirements for different levels of responses will certainly get students thinking about the content. However, if the goal is to encourage students to think deeply about the content, strategies that promote collaboration and engagement with the community and instructor are necessary. A role playing strategy helps students think about the content and integrate it with the perspective they are assigned to represent. The debate format does the same, but it introduces an enhanced interaction among discussants as they try to defend their positions and understand the positions of their colleagues. The scaffolded format relies on the teacher to make sure that engagement with content and fellow student occurs. Asynchronous discussions promote cognitive presence, but the quality of the discussion is related to the strategies implemented and has an impact on the level of discussants' cognitive presence.

Assessing Discussions

Content analysis is a common approach to analyzing data collected from threaded discussions (Yang, Richardson, French, & Lehman, 2011). Seminal work by Henri (1992) explains the usefulness of content analysis to the assessment of computer mediated conferencing (CMC). In his work, Henri discussed content analysis, and his

examination provided practical and theoretical/conceptual arguments for using content analysis in this study. Content analysis provides both a practical data analysis technique for use in this study and a way for teachers to utilize the threaded discussions as they assess their students' knowledge creation. The scope of a content analysis approach also aligns with the purpose and practice of the assessment for learning process.

Henri (1992) made the point that CMC is relatively easy for research non-professionals to use. However, while content analysis may provide a means for researchers to code the meanings contained in CMC messages, the framework may be too complex for everyday use by teachers engaged in daily assessment of students' work. This is especially important given the fact that the assessment for learning process relies on frequent and continuous assessment. One strength of content analysis lies in its applicability to the problem of categorizing different levels of students' thinking during discussions. Content analysis as described by Henri includes 5 categories/buckets within which a teacher or researcher can place various sentences or messages posted by discussants. These categories are aspects of the sentences or messages that suggest participation, social involvement, interaction among discussants, cognitive engagement, and metacognitive engagement (p. 126).

Henri (1992) developed a model that can be used to analyze sentences or messages to determine a best fit with each of these categories. This model goes beyond simply organizing the sentences or messages according to themes but provides a way to frame the discussant's thinking at the time of the post (p. 121). There is a focus on content as well as the development of knowledge. The model includes the 5 categories,

definitions to guide classification, and sample statements that serve as indicators of the kind of comment that reflects a particular category (p. 125). Once sentences or messages have been classified, they can then be counted and used for quantitative analysis of the nature of CMC sentences or messages and the intended meanings of participants.

Because it allows for the categorization and analysis of CMC sentences or messages content analysis is suited for use in community of inquiry studies. Shea et al. (2010) stressed the point that content analysis is useful for community of inquiry because it provides a way to directly gauge meaning in CMC sentences or messages. As it sheds light on the intended meanings of CMC participants, a content analysis of CMC sentences or messages can also highlight incidences of teacher, social, and cognitive presence in a discussion forum. Henri (1992) explained that CMC messages are collaborative exercises and noted that content analysis facilitates targeted analysis of messages to better understand discussants' meanings. Andresen, 2009 alluded to the same utility of content analysis when he noted that content analysis facilitates assessing asynchronous discussions despite the volume of posts and the fact that contributions to a discussion are posted after discussants have read and processed the thread.

Garrison, Anderson, and Archer (2000) utilized content analysis to identify cognitive presence in CMC. The researchers noted that analyzing CMC was particularly problematic because physical cues like body language were not evident in a discussion transcript. They also noted that transcripts provided a large amount of data that needed to be assessed. In their study, Garrison et al. developed a model similar to that developed by Henri (1992). Garrison et al.'s model included 5 buckets that represented different levels

of cognitive presence in CMC messages, and like Henri they utilized a set of definitions and examples to guide placement of CMC messages into the various buckets. Garrison et al.'s buckets were the triggering event, exploration, integration, resolution, and no cognitive presence.

The 5 stages in Garrison's model provide a way to categorize different levels of student thinking during a discussion. In Garrison et al.'s model, the triggering event refers to when the learner first becomes aware of the objective or learning problem facing them. During the exploration phase, the learner may restate the problem as they explore its nature and better understand what the problem is and what might be relevant to its solution. The integration phase is where learners may bring prior learning to bear on the problem and attempt to apply solutions or make connections to their existing knowledge base. The resolution phase is characterized by the acceptance of a solution or the fit of new learning into an existing schema of knowledge.

In addition to its usefulness in categorizing CMC sentences or messages according to the levels of cognitive presence, another strength of content analysis is its alignment of focus with the assessment for learning process. Content analysis and assessment for learning both focus on the process of learning. Henri (1992) explained that content analysis is focused on the process of learning not the content that might be mastered as a result of that learning. Learning in the online environment is decidedly more individualistic than in a classroom setting. As CMC sentences or messages are key aspects of online learning and as learners' mastery of content is less obvious, content analysis provides a way to focus on the process of learning. Garrison et al. (2000) utilized

content analysis in their study for this very reason. The researchers wanted to identify the processes that contribute towards cognitive presence. Akyol et al. (2009) had a similar focus when they used content analysis in their study. They intended to discover the processes involved in the development of a community of inquiry.

There are other instances where content analysis has been used to assess asynchronous discussions. Shea et al. (2010) utilized content analysis in a study focused on a simultaneous study of all aspects of the community of inquiry model. They studied two identically designed online courses in Business Management delivered at a college in the northeast United States. Of the five research questions, two were of particular importance to this study. One question focused on the methodological issues arising when quantitative content analysis is used to measure cognitive presence. The other question required the utilization of content analysis to measure all presences including cognitive presence. The researchers utilized inter-rater reliability and employed the services of instructional designers and content experts to design the learning activities.

Weltzer-Ward (2010) reviewed 136 studies utilizing content analysis from seven journals between 2002-2010. The purpose was to synthesize the reported 56 coding schemes (p. 58) utilized for analyzing asynchronous discussions and report a common approach to coding during content analysis. Weltzer-Ward reported that many coding schemes were particularly focused on identifying instances of critical thinking. It is noteworthy that Weltzer-Ward discovered that among the various coding schemes found in her review, the largest subset were related to Henri's (1992) work and the work of community of inquiry scholars cited in this study.

The uses of content analysis cited above suggest three salient features of content analysis. First, it facilitates the identification of statements suggesting cognitive presence. Second, it provides buckets within which an assessor can categorize statements that give insight into the thinking processes behind students' posts. Third, as a result of the first two points, it is a vehicle for assessing the posts for evidence of students' knowledge construction.

Black and Wiliam (2009) and FAST SCASS (CCSSO, 2008) both described assessment for learning as being concerned with the process of learning. The FAST SCASS has consistently argued against treating assessment for learning as simply the assessments that may be used during the process and have explained that assessment for learning is a process. The works of Brookhart (2008), Gikandi et al. (2011), Glassmeyer et al. (2011), Heritage (2007), and others supported this focus. Therefore, the assessment vehicle used in this study must address the process of knowledge construction. However, mastery of content must also become evident as a result of the discussion and the assessment vehicle must be easy enough for teachers to use in everyday practice.

Not all researchers advocate utilizing content analysis to focus on the process of learning. Yang, Richardson, French, and Lehman (2010) conducted a mixed methods study to develop an alternative content analysis model that focused on both mastery and the process of learning. Yang et al. (2011) lamented the shortcomings of studies utilizing content analysis to examine CMC messages or to develop models of content analysis. The researchers argued that content analysis should focus on both mastery and the process of learning. Their qualitative-quantitative sequential analysis relied upon

grounded theory in the first phase and tested the results in the quantitative phase. With (N=31) graduate students from two separate courses in a WebCT environment, the researchers required students to contribute between 2-3 posts every week. The result was a dual model with 4 categories for knowledge creation and seven for cognitive skills. The cognitive skills categories were sharing and describing, referring to/describing, describing/communicating/summarizing, observing/asking questions, explaining/comparing/interpreting/clarifying, providing information, analyzing/concluding, clarifying misconceptions, applying, and using a theory, creating, and raising new ideas.

Yang et al. (2010) also noted that indications of reliability and validity were not included in almost half of the studies the researchers reviewed (p. 47). The researchers ensured content validity by utilizing content experts to review the possible discussion topics that could be used in the study. Another approach, and one that was used in this study, is to rely upon a curriculum and an independent summative test outline to ensure that discussion topics are related to the learning objectives for the course in which discussants will be enrolled. Indeed, the assessment for learning process requires the establishment of learning goals as a way to ensure that teachers' and students' activities are focused on developing understanding.

In Yang et al.'s (2010) study, reliability was addressed by implementing procedures to ensure inter-rater reliability and to resolve differences that arose among raters. Coding discussion transcripts consistently was one way that Yang et al. believed their study would enhance the model they developed. In this study, acceptable procedures

for ensuring inter-rater reliability and for resolving differences will be utilized along with training of raters to recognize and categorize statements that tell about cognitive presence. For this reason, it will be preferable to use as simple a model as possible so that raters can quickly grasp the nuances of varying levels of cognitive presence.

Some aspects of assessing asynchronous discussions are not addressed by the content analysis model. Hew, Cheung, and Ng (2010) and Ward and Dodd (2011) identified low participation as a characteristic of some asynchronous discussions. It is difficult to effectively and accurately assess discussions when student participation is low. Hew et al. employed a constant comparative approach to review (n=50) articles from 7 electronic databases using the keywords online discussion, computer-mediated communication, and online learning. The purpose of their review was to identify factors that contributed to low discussant participation. The researchers identified 7 contributing factors. These included being unaware of the need for online discussions, personality characteristics, interaction among discussants, maintaining or keeping pace with the discussion, not being able to critically respond in the discussion, not knowing what to post, and technical factors like characteristics of the software being used.

Hew at al. (2010) concluded that there were various measures that could be employed to address the reasons for low participation. Among them were choosing topics that directly relate to the curriculum, assigning a grade and making participation mandatory, providing expectations and guidelines for participation, requiring discussants to summarize the salient aspects of the discussion, and establishing deadlines for posting. These measures could be employed in the form of a rubric that establishes posting

requirements, links the topic to the curriculum, facilitates the assignment of a grade, and scaffolds the level of contributions so that summarizing becomes a required aspect of discussants' contributions. Such a rubric may be shared with discussants to help them self-assess and regulate their participation. Therefore, it was useful for the teacher in this study to include a rubric as a tool for students' self assessment.

In a quantitative study by Ward and Dodd (2011), discussants' attitudes to asynchronous discussions were examined with respect to their performance in a blended course. The purpose of the study was to evaluate students' reactions to a module that relied heavily on asynchronous discussions as a means of instruction and assessment. This study involved (n=40) final year counseling psychology students batched in groups of 10 discussants. The overall grade in the course was used as an indication of success in the course. The grade included a final paper critiquing students' contributions. A Likert scale was also used to determine students' attitudes towards utilizing the asynchronous discussion in the course. Discussants were provided with guidelines for posting that included advice on how to think critically about the discussion. Ward and Dodd found that there was a positive correlation between students' attitudes towards the discussion and performance in the course. This supports the notion that a rubric might be useful in encouraging discussant participation and enhancing overall performance.

Cheng, Jordan, Schallert, and the D-Team (2013) utilized an approached to assessing asynchronous discussions that focused on content mastery and knowledge construction. The researchers called these constructs knowing and learning. Altogether 24 graduate students participated in the study and posted in four discussions. Data was

extracted from the third and fourth discussions and the fourth discussion was assessed as a final test. The third discussion did not count for a grade and was seen as everyday course interaction. The researchers sought to examine the similarities between knowing and learning in the online context of an asynchronous discussion. Cheng et al. developed the constructs of knowing and learning because they argued that traditional one dimensional models of asynchronous discussion assessment that were either quantitative or qualitative in nature focused exclusively on demonstrations of content mastery or evidence of cognitive presence. The researchers were interested in determining the value of discussions with respect to both knowing and learning.

The findings of Cheng et al. (2013) showed that when students were aware that an asynchronous discussion counted as a grade, they raised their level of discourse thus indicating that they had mastered the material. However, the researchers also found that across discussion purposes, assessment or everyday course interaction, discussants were posting messages indicating that they were learning from the discussion. The researchers used Spearman's rho to find that there was correlation within each discussion purpose for both knowing and learning constructs, r (22)=.74, p<0.0001 for the everyday discussion and r(22)= .57, p=0.003 for the assessed discussion (p. 57). However, the researchers found that the scores for the learning construct dropped during the assessed discussion, though not significantly. The researchers attributed this to the fact that discussants restricted their posted to just comments that would give them a high grade. Therefore, the assessment purpose seemed to restrict students' online posts and reduce opportunities for

learning. This aligns with the point made by Black and Wiliam (2009) that test scores may communicate a sense of finality to students.

This study utilized a model similar to that developed by Garrison et al. (2000). In Garrison et al.'s model, the triggering event, exploration, integration, and resolution phases refer to textual evidence of different levels of cognitive presence. The triggering event refers to when the learner first becomes aware of the objective or learning problem facing them. During the exploration phase, the learner may restate the problem as they explore its nature and better understand what the problem is and what might be relevant to its solution. The integration phase is where learners may bring prior learning to bear on the problem and attempt to apply solutions or make connections to their existing knowledge base. The resolution phase is characterized by the acceptance of a solution or the fit of new learning into an existing schema of knowledge. In order to interpret transcripts according to these phases a coding scheme describing possible entries that align with each phase will be necessary. The coding scheme used for data analysis in this study will be one utilized by Shea et al. (2010) (Appendix D) and permission has been received for such use. This scheme was based upon the work of Garrison et al.

Summary

Assessment for learning is a process that can inform a pedagogy and the community of inquiry model provides a perspective from which to view and analyze interactions in online education. The assessment for learning process can be used to design instruction aimed at increasing cognitive presence in the online arena. The works of Black and Wiliam (1998) and the FAST SCASS (2006) defined the process and

identify attributes that are part of the process. This study relied upon the process and attributes as defined and explained by the FAST SCASS. Though researchers (Kingston & Nash 2011; Clark 2010; McMillan, Cohen, Abrams, Cauley, Pannozzo, & Hearn 2010; Herman, Osmundson, & Silver 2010; Pachler, Daly, Mor, & Mellar 2010; Heritage 2010) have suggested that there is too much confusion around the meaning of assessment for learning, the works of the FAST SCASS and Black and Wiliam have been shown to define assessment for learning similarly and has been compared to seminal work by Scirven (1967). Three critical components of assessment for learning as defined by both the FAST SCASS and Black and Wiliam were identified for this study. These are providing learning goals and success criteria, the nature of feedback, and student involvement in the learning process.

Studies focused on the implementation of assessment for learning have indicated that the process positively impacts the learning process (Weurlander, 2010; Klisc, McGill, & Hobbs, 2009; Hodgson & Pang, 2012; Hwang & Chang, 2010; Lawton, Vye, Bransford, Sanders, Richey, French, & Stephens, 2012). Despite references to the positive impact of assessment for learning, studies did not feature approaches where the entire process as described by Black and Wiliam (1998) and FAST SCASS (2006) are incorporated. Instead, assessment for learning is usually incorporated as the inclusion of formative questions and the provision of feedback. Also, in each of these studies the impact of assessment for learning has been measured with respect to different variables, perception of learning and achievement. This study focused on the relationship between a

full implementation of the assessment for learning process and a specific variable, cognitive presence.

Seminal work by Garrison, Anderson, and Archer (2000) has helped to define the community of inquiry model as a way of looking at the educative interactions within an online learning community. Additional work by Shea et al. (2010), Akyol, Garrison, and Ozden (2009), Garrison, Cleveland-Innes, and Fung (2010), and Akyol and Garrison (2011) have described the nature of teaching, social, and cognitive presence. They have also shown that these various components of the community of inquiry model are interrelated and complementary. These works have facilitated a comparison between community of inquiry and assessment for learning that alignment between the critical components of the assessment for learning process and teaching, social, and cognitive presence.

The asynchronous discussion vehicle used in this study is appropriate because it provides a means for students to demonstrate aspects of both the community of inquiry model and the assessment for learning process. This review identified attributes of effective asynchronous discussions from the works of Nandi, Hamilton, and Harland (2012) and Persico, Pozzi, and Sarti (2010). These attributes, the opportunity for reflection, the use of self-regulation by discussants, the development of community, and cognitive presence, all align with community of inquiry and assessment for learning. They also indicate that asynchronous discussions may be part of a student's process of knowledge acquisition or learning process. As such, the choice of an asynchronous

discussion to be the vehicle to observe the impact of assessment for learning on cognitive presence is a fitting one.

Since this study focused on students' learning process and important elements of the study including the theoretical and conceptual foundations address the learning process, it was useful to utilize a method of analysis that has been proven to highlight the learning process. Content analysis has been shown to be effective in highlighting the learning process (Henri, 1992; Shea et al., 2010; Andresen, 2009; Garrison, Anderson, & Archer, 2000; Akyol, Anderson, & Garrison, 2009; Shea et al., 2010; Weltzer-Ward, 2010). Various approaches to doing content analysis exist within the body of knowledge around online learning. However, rubrics have also been shown to be effective in motivating students to assess their own performance in discussions. While content analysis will be the most appropriate tool to use for analysis of transcripts, a rubric based upon the work of Hew, Cheung, and Ng (2010), Cheng, Jordan, Schallert, and D-Team (2013), and Yang, Richardson, French, and Lehman (2010) would be a useful tool that can play a part in a full implementation of the assessment for learning process.

The purpose of this study was to examine an instructional interaction to determine whether there was any relationship between the full implementation of the assessment for learning process and students' cognitive presence during an asynchronous discussion. Three important aspects of this study intersected during data collection and analysis, the assessment for learning process, asynchronous discussions, and the community of inquiry model. The literature around assessment for learning does not include many instances of a full implementation of the process. Instead many studies have focused on aspects of the

process like feedback or assessment (Weurlander, Soderberg, Scheja, Hult, & Wernerson, 2012; Hung, Lin, & Hwang, 2010; Lawton, Vye, Bransford, Sanders, Richey, French, & Stephens, 2012; Hwang & Chang, 2010). These studies also target a different body of participants than will be the focus of this study. Instead of adult or early learners, the focus of this study will be adolescents, high school students.

The choice of the asynchronous discussion as a context for examining the implementation of the assessment for learning process fits with the purpose of examining cognitive presence. The literature around the implementation of asynchronous discussions suggests that asynchronous discussions are effective tools to encourage cognitive presence (Akyol & Garrison, 2011; Arend, 2007; Arend, 2009; Baglione et. al., 2007; Darabi et. al., 2010; Schellens &Valcke, 2006). The community of inquiry framework is a useful lens with which to examine asynchronous discussions because it contains many of the aspects researchers have determined make asynchronous discussions effective Nandi, Hamilton, and Harland (2012) and Persico, Pozzi, and Sarti (2010). The community of inquiry model also aligns with the assessment for learning process and the Deweyan and Vygotskian principles that provide the social-constructivist worldview that guides this study.

During this study two teachers taught a single topic to two sections of Modern World History. Both sections participated in separate asynchronous discussions and data from the transcripts that were generated from content analysis served as baselines to evaluate the incidence of statements reflecting cognitive presence in each group. A second discussion was facilitated during a new topic for instruction. With the control

group, one teacher utilized instructional strategies that are based on the school's network guidelines and that do not incorporate deliberate attempts to utilize assessment for learning. With the treatment group, another teacher fully implemented the assessment for learning process. Content analysis was performed on the transcripts from the second discussion to yield data for study. Both sets of data were statistically analyzed to gauge whether there was a relationship between implementing the assessment for learning process in totality and the incidence of different levels of cognitive presence.

The following sections of this chapter will focus on a detailed description of the research design used and a rationale for using that design. The research questions will be aligned to the design to show how the chosen design helps to answer the questions. Following that, there will be a thorough description of the context for this study. This will include the school mission and its guiding frameworks, the student body population, the school pedagogical guidelines, an alignment between the school's pedagogical expectations of the teacher and the assessment for learning process to show similarities and differences between the two, the sampling process, and the school technology including the LMS to be used. Next, there will be sections on data collection details, statistical tests to be used, steps taken to promote validity and reliability, and procedures to ensure the protection of participants.

Chapter 3: Research Method

Introduction

In this chapter, I discuss the research design for this study. I used a quasi-experimental approach to data collection and analysis. In the following sections I present the research questions and hypotheses, and explain the rationale for using the quasi-experimental approach. A discussion about the sampling method, the impact of time and a brief outline of the procedures will follow. I next explain the context of the study and the data collection procedures, and conclude with a discussion of potential threats to validity.

Research Questions

In order to test the hypothesis that there was a positive relationship between the application of an assessment for learning approach in the design and facilitation of asynchronous history discussions among high school students and the levels of cognitive presence evidenced in the transcripts of those discussions, I asked the following research question and subquestions, and tested the following null hypotheses.

RQ: Does implementation of an assessment for learning approach in the design and facilitation of an asynchronous discussion result in significant differences in cognitive presence messages among high school students during the asynchronous discussions?

H_{01}: There is no significant difference in cognitive messages during the asynchronous discussions.

H_{a1}: There is a significant difference in cognitive messages during the asynchronous discussions.

SQ1: When instruction does not include assessment for learning, what levels of cognitive presence messages are evident?

SQ2: When assessment for learning is applied, what levels of cognitive presence messages are evident?

SQ3: What change in teachers' teaching presence is evident during the asynchronous discussions?

SQ4: What relationship exists between changes in teaching presence and cognitive presence between the asynchronous discussions within each group?

H_{01}: There is no relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

H_{a1}: There is a positive relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

H_{a2}: There is a negative relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

Research Design and Rationale

Several researchers have explained that true experiments are the best way to test theories in a way that can result in the drawing of strong causal conclusions (Clow & James, 2014; Frankfort-Nachmias and Nachmias, 2008; Suter, 2012). Among other characteristics, true experiments allow for randomization in sampling that is not a feature of quasi-experimental designs (Clow & James, 2014; Steiner, Wroblewski, & Cook,

2009; Suter, 2012). Sometimes experimental designs are matched by a post-positivist worldview because it promotes the causes that give rise to outcomes. However, the foundation of this study was a social-constructivist worldview which often forms the basis of qualitative approaches. The social-constructivist worldview promotes exploration of phenomena, but also focuses on the interaction among individuals. In this study, I assumed that the quality of educative experiences depends on interactions within a community of learners—an assumption in keeping with a social-constructivist worldview. My focus, however, was trained on explaining the relationships among variables, and thus seemed to require a quantitative design.

A true experiment was not appropriate for this study. Experiments in quantitative research designs have a stimulus-response approach to examining phenomenon. Social scientists are hard-pressed to study phenomena in a way that allows the strict employment of stimulus-response. Frankfort-Nachmias and Nachmias (2008) made the point that the stimulus-response approach of experimental designs is different from the type of property-disposition focus on interactions among social phenomena that social scientists employ. The differences separate the two approaches in ways that make it complicated for social scientists to adopt true experimental designs. Frankfort-Nachmias and Nachmias mentioned four ways that the property-disposition and stimulus-response differ. These are time interval, degree of specificity, nature of groups, and time sequence of events. In this study, three of these four differences were present in ways that preclude an experimental design. Also, ethical, practical, and legal constraints make experiments

difficult to conduct in a social setting (Kirk, 2013; Steiner, Wroblewski, & Cook, 2009). For these reasons, I used a quasi-experimental approach in this study.

A quasi-experimental design allowed me to study actual students and their interactions without ethical violations and did not require the random assignment of participants. Also, the probabilistic nature of the quasi-experimental design allowed me to focus attention on the relationships between students' cognitive presence and the assessment for learning approach. Frankfort-Nachmias and Nachmias (2008) identified three commonly used types of quasi-experimental designs. These are the contrasted groups designs, planned variation designs, and time series designs. The most common quasi-experimental design is the contrasted groups or non-equivalent groups design (Andranovich & Riposa, 1993; Cook & Wong, 2008; Steiner, Wroblewski, & Cook, 2009)

I used a non-equivalent groups design with pre- and posttests. Baldwin and Berkeljon (2010) noted that the inclusion of the pretest in this design allows for the estimation of any selection bias that may exist as a result of the non-random selection of participants. Including two groups, a control group and a treatment group, also strengthens this particular quasi-experimental design. Steiner, Wroblewski, & Cook (2009) noted that in situations such as those that existed in this study, where assignment to either group was done prior to the treatment, it is not possible to exclude what Kirk (2013) called "nuisance variables" (p. 8) that may confound conclusions. However, Suter (2012) suggested that matching groups may afford some approximation of randomness and reduce nuisance variables so as to further strengthen this design. Suter noted that if

matching groups was to be effective in approximating randomness, the criteria matched needed to be relevant to factors that tend to affect the variables involved. In the context of education research, Suter has identified those factors as age, sex, and the socio-economic status of participants.

Methodology

Population and Context

The context for this study was a high school in a city in Maryland referred to hereafter as "City High School" or "CHS." I refer to the city as City. CHS is part of a network of schools hereafter referred to as "The Network." The network is made up of 30 schools across 17 states and Washington DC educating around 9,000 students. The Network functions in an advisory capacity to CHS, provides its curriculum, frames its mission, and formulates its standards for pedagogy and student achievement. As part of the Network, CHS offers a college preparatory education to a specific demographic comprised of students from low-income families who live in urban centers. The median income of students' families is around $34,000. Around 96% of its students are not of Caucasian descent. An integral part of the design of network schools is a corporate internship program. This program places students in specific jobs one day per week where they gain valuable professional experience and the sponsoring agency pays the student's compensation towards their tuition.

CHS uses the Danielson (Danielson, 2007; 2008) framework to promote pedagogical effectiveness by establishing standards that teachers must strive to attain. This is important to note because of the alignment in practice between the Danielson

framework domains and the assessment for learning process (Appendix E). This alignment means that the treatment teacher in this study was striving to achieve standards of practice that are quite similar to the attributes of the assessment for learning process. However, like much of the research cited earlier regarding the implementation of the assessment for learning process, there is no reference to a unified assessment for learning process among the network schools. Instead, the schools regard the domains of the Danielson framework as different aspects of high quality teacher practice.

CHS uses technology in innovative ways to enhance instruction. The school employs a full-time director of information systems who manages the school's network and technology assets. Students at CHS are exposed to blended-learning approaches, regular use of Google applications, and email correspondence. The discussion in this study took place within a Moodle. CHS also uses a Moodle as its learning and content management system. Students utilize the school Moodle to download assignments, engage in discussions, and interact with peers and teachers.

Participants in this study were all upper classmen, who numbered 115 students. I studied participants from two Modern World History sections (N = 40). Of this sample, 80% were African American, 12% were Latino or Hispanic, and 7% were Caucasian. The distribution of ethnic groups was uneven across sections. The treatment group was made up of 21% Latino or Hispanic students, and 4% Caucasian students, and 75% African America students. The treatment group comprised 14 students. The control group was made up of 8% Latino or Hispanic students, 8% Caucasian students, and 84% African

American students. I addressed the validity concerns arising out of the uneven nature of ethnic distribution by using a pretest to evaluate the groups' comparability.

Both teachers of the two sections were new to the school. This was their either their first or third year at CHS. They were also new to the teaching profession and were in their second or third year of teaching. As a condition of their employment at CHS, they were required to travel to Chicago in the summer of 2013/4 for intense professional development around the Network frameworks, curriculum, and pedagogy. They received additional professional development from the Network during the summer of 2014. The professional development was sponsored and delivered by professional teacher trainers working with the Network. Both teachers also teach a junior- and senior-level course in World History.

Sampling

I did not randomly assign the groups of discussants in this study because the participants were already members of intact groups. It would have been unethical and impractical to attempt to randomly assign members to either group. The groups existed as a result of school policies and practices and could not be changed easily. It was also not possible to assign groups that included identical participants because each group was made up of distinct individuals. The nature of the school enrolment policies is pertinent here. The school is part of the Network which restricts admission to working families living within the City who earn below $34,000. Socio-economic status of students in the school and their approximate age were therefore two common characteristics of members in both the control and treatment groups.

The time sequence of events also presented a restriction on the type of design that I could employ in this study. While the teachers provided instruction in Modern World History, the participants continued to learn in other subjects with other teachers, and may have been engaged in other asynchronous discussions during the course of the discussion under study. Therefore, it was not possible to treat the implementation of the assessment for learning process as a clear stimulus that solely determined the responses that I observed. Instead, I took measures to provide a general idea of discussants' cognitive presence in Modern World History discussions before the treatment, which I then compared to the cognitive presence I observed after the treatment. This means that unlike results in an experimental design which may result in conclusions that may be applicable in broad situations, the results of this study may only be applicable in a narrow range of cases.

In this study, participants comprised two sections of high school students studying Modern World History. One section was the control group and the other the treatment group. Participants engaged in an asynchronous discussion, the analysis of which yielded data to form a pretest of discussants' cognitive presence. The treatment group teacher reviewed online professional development materials focused on the assessment for learning process and worked with an assessment for learning coach. The teacher then implemented the process in the design and moderation of a second asynchronous discussion. The control group teacher also designed and facilitated a second asynchronous discussion. I analyzed transcripts from both to yield posttest data.

Procedures for Data Collection

The pre and post tests in this study took the form of two asynchronous. Both discussions occurred within the CHS Moodle. The standard Moodle Q and A Forum type was used for the discussions. This forum type required students to post first before seeing others' posts. The forum also allowed for nesting so that students could respond easily and track their responses to other specific students. Transcripts from both discussions were generated from a Moodle reporting function. Names were removed during analysis and replaced with identifying codes that did not reveal the identities of discussants. Each of the discussions were open for two weeks during which time the students were expected to post their responses and respond to others.

The pretest took the form of an asynchronous discussion on a specific but common topic in the Modern World History curriculum across both sections. Instruction was delivered by the same teacher, during the school day, on the same days, at the same time of the school year. When the teachers delivered their instruction for the second topic, the treatment group experienced instruction and discussion design and facilitation guided by the assessment for learning process. This was the treatment aspect of the study. Following this, a second asynchronous discussion was conducted which constituted the post test. A summary of findings was provided to the school and an information session was offered to families where the findings can be discussed and explained.

Instrumentation

The coding schemes used in this study were developed by Shea et al. (2010). Permission was sought and received to use the instrument in this study. Shea at al. used

their instrument to evaluate asynchronous discussion posts of college students enrolled in business courses in a Northeastern college. However, the instrument was also used in a study examining cognitive presence in dually enrolled high school students (Mitchell, 2012). In this study, Mitchell analyzed discussion posts by high school students enrolled either in the 11th or 12th grade who also chose to simultaneously take a college course at a Midwestern community college. While the model developed by Shea et al. focuses on all aspects of the community of inquiry framework, this study only utilized the parts of the model dealing with recognizing cognitive presence (Appendix D) and teaching presence (Appendix E).

Treatment Programs

Assessment for learning professional development was provided to the treatment teacher from within a Moodle, MyAlec.org. The experience comprised professionally developed instructional videos from EduGains (http://www.edugains.ca) which is a website that hosts professional development resources for K-12 teachers in Ontario, Canada. In addition, research literature and excerpt readings were provided as part of the experience as well as professional publications from FAST SCASS. The teacher also received coaching from an assessment for learning expert who was a former member of the FAST SCASS and former Program Director of Maryland's Formative Assessment Race to the Top Project. As mentioned earlier, the treatment teacher was striving to achieve standards of practice that align closely with the assessment for learning approach and the principal intended to continue to promote a formative assessment approach

among his staff. This treatment did not constitute anything that the school does not intend to explore itself.

The treatment teacher ensured that his design and facilitation of the post test discussion conforms to the attributes of the assessment for learning process. The design and facilitation incorporated the following:

- Focus on a portion of the curriculum that was part of the learning progression of a larger topic
- Clear communication of learning goals that included student discussion and exploration to ensure they internalized the parameters of the learning goal
- Examples of work products and a rubric that served as success criteria
- Evidence of learning in the form of requirements for discussion posts
- The provision of feedback that was descriptive in nature
- The opportunities for and encouragement of a climate that fostered self and peer assessment
- Requirement for collaboration

The implementation of these aspects of the treatment were documented and have been reported later in the study

Data Analysis

Transcripts of both discussions were analyzed through content analysis utilizing the coding schemes developed by Shea et al. (2010). Transcripts were analyzed at the sentence level to ascertain the distribution of cognitive presence messages reflecting the

various levels in the Shea et. al model, triggering event, exploration, integration, and resolution. The intention was to use ANCOVA to analyze pre test data to compensate for differences within the groups. ANCOVA was to be utilized again to compensate for differences and ANOVA was to be utilized in each group to determine the significance of differences among discussants with respect to the frequency of cognitive presence messages. Data that was ultimately collected did not lend itself to variance analysis using ANCOVA and ANOVA. Instead, chi-squared analysis was used to test independence. Justification for this will be provided in the data analysis section. Content analysis was used to look for teaching presence of both teachers between the pre and post test. This study focused on the change in discussants' cognitive presence between the first and second discussion. However, students were not the only participants in the discussion. The teachers played a role in the design and facilitation of the discussion. In the community of inquiry model, this is referred to as teaching presence. It was useful to note the role of teaching presence of each teacher between the first and second discussion given the blended nature of the course and if the correlation with the incidence of cognitive presence messages among students.

Threats to Validity

Researchers (Baldwin & Berkeljon, 2010; Cook, Shadish, & Wong, 2008; Andranovich & Riposa, 1993) have noted that quasi experimental studies are particularly susceptible to internal threats to validity which restricts the inferences that may be drawn from findings. Without the benefit of random sampling quasi experimental studies may be confounded by the existence of extraneous variables (Klow & James, 2014). Baldwin

and Berkeljon (2010) identified several possible threats to internal validity during quasi-experimental design studies. These are threats of history, maturation, selection, attrition, testing, instrumentation, regression, and timing.

History threats to internal validity may occur because students are engaged in a treatment that stretches over a period of weeks. This cannot be avoided but as a means of addressing this threat, it should be noted that the sections of Modern World History participating in the study shared and common educational experiences within CHS because of the limited curriculum choices available to students at the school. With respect to the maturation of participants, the discussions did not stretch for more than one month. This minimized the impact of any possible maturation threat. Selection threats to internal validity were real for this study as the sections are not identical. Baldwin and Berkeljon (2010) noted that when pre and post tests were part of the nonequivalent groups design it helps to clarify the occurrence of maturation and selection threats to validity.

Attrition was another real threat to internal validity for this study. Participants have selected to be enrolled in CHS as opposed to being placed there as a consequence of their addresses. This made it likely that students would remain enrolled in the school. Since the discussions were part of the instructional strategies used within the school, it made it less likely that students would have opted out of the study because it was novel or disruptive. However, if participants had decided to drop out of the study, the sizes of the two sections were large enough to withstand losses of students and still field a functioning and vibrant discussion.

Testing and instrumentation threats to internal validity were also not significant for this study. The discussion prompts was different for pre and post-test though the overarching topic was the same. Discussants were not able to draw on memorization of items as in a common test because the goal of the discussion was different. Discussants were able to employ additional prior knowledge during the post-test as the material was provided sequentially. However, this did not represent anything out of the ordinary for educational research in a school setting. The instrument used to analyze cognitive presence remained static for the duration of the study thus eliminating any chance of modifications to an instrument confounding findings.

The study did not suffer from regression threats to internal validity. Participants were not selected based upon any prior scores on history tests or any other test. CHS does not utilize an admissions examination. Students attending CHS are there by choice. Within each group there was a divergence of ability. The intention was to account for and report this through the application of ANCOVA tests, but chi-squared analysis was used instead to test for independence.

Timing is another threat to validity identified by Baldwin & Berkeljon (2010). The researchers noted that in quasi experimental studies it is sometimes difficult to ascertain which variable occurred first during an intervention. This makes it difficult to offer plausible explanations for observed changes. In this study, the focus was on one dependent variable, cognitive presence. The use of pre and post tests and chi-squared test for independence helped to isolate that variable so that it was reasonable to assert whether or not any observed changes in the dependent variable were related the treatment.

There are external threats to validity as well. This study only supported narrow generalizations to the general population. CHS targets a specific demographic. Only students living in urban areas whose income stands at around $34,000 or an adjusted amount based upon members of the household may attend the school. The participants in the school are overwhelmingly of African American descent or Latino or Hispanic heritage. The curriculum is college preparatory and as such accelerated. The school is also a Catholic institution though only 29% of the students are Catholic. In response, findings can only be generalized to similar populations therefore limiting the impact of this study. However, the findings may signal a need to conduct additional research across a broader population.

Reliability

Frankfort-Nachmias and Nachmias (2008) explained that assuring reliability is particularly problematic in the social science because the phenomena being measured are usually measured indirectly. This means that the chance for errors in measurement rises because a coder may interpret the indirect evidence incorrectly or there may be a problem with the indirect evidence that may give rise to a false measurement. In this study, cognitive presence was being measured indirectly through the use of a model (Shea et. al, 2010). It was expected that the robust nature of the model will help coders readily identify whether or not cognitive presence was evident in messages and if so of what level. In order to increase the reliability of this study, two steps were taken.

First, the discussion transcripts were evaluated at the sentence level. The nature of the model (Shea et. al, 2010) required the assessors to scrutinize sentences for evidence

of cognitive presence and scorable elements of the transcripts. In their examination of the efficacy of sentence over message level content analysis, Gorsky, Caspi, Blau, Vine, and Billet (2012) discovered that sentence level analysis yielded richer bounties of instances of cognitive presence.

Another potential issue with the study's reliability is that the data collected as evidence of discussants' cognitive presence may be erroneously measured by coders. Akyol, Vaughan, and Garrison (2011) and Akyol and Garrison (2011) used multiple coders to increase their study's reliability. Three different coders were trained to identify evidence of cognitive presence and difference resolution measures were employed to resolve any conflicts.

Ethical Concerns

All stakeholders were duly informed of this study and the option to decline or withdraw was ensured. Families of participating students were informed as to the purpose of the study, an overview of activities, its expected duration, and the possibility for the adoption of strategies on the part of both teacher and student as a result of the experience. The following IRB document permissions, Minor Assent forms, Parent Consent forms, and Letter of Cooperation were not required as the study utilized teachers' scores of what was a planned assignment. Identities of teachers and students were concealed for privacy purposes. Documents providing any personal information utilized in this study were destroyed so as to prevent unauthorized use.

Summary

This study employed a nonequivalent control group design to study the relationship between implementing and facilitating an asynchronous discussion according to the assessment for learning process and the incidence of statements indicating cognitive presence. Though the underlying worldview is a social-constructive one, the examination is being restricted to the relationship between two variables. For that reason this quasi-experimental design was chosen for this study. The lens through which the impact of the assessment for learning process was evaluated is the community of inquiry framework (Garrison et. al., 2007) which has a strong research base that was explored in chapter 2. The tool that will be used to identify statements indicating cognitive presence also has a strong research base and has been used in studies by Shea et al. (2010).

Chapter 4: Results

Introduction

The purpose of this study was to investigate whether there was a relationship between the levels of cognitive presence evident in an asynchronous discussion and the application of the assessment for learning process. The assessment for learning process is a set of attributes that guides interactions between teachers and learners. Black and Wiliam (1998) and FAST SCASS (CCSSO, 2008) have suggested that the assessment for learning process helps students play a central role in their learning by laying out and coordinating essential strategies or attributes. By institutionalizing these strategies and making them formally a part of what students do during their learning, the assessment for learning process has a more pronounced impact on lower achieving learners than higher achieving ones (Black & Wiliam, 1998).

In this study, I focused on whether the application of the assessment for learning process would have such an impact on discussants as they used an asynchronous discussion to learn as well as to demonstrate understanding. Cognitive presence, which is a component of the community of inquiry model, facilitates a close examination of students' posts to estimate whether or not they are mentally engaged—a possible indication that students are in the process of learning. I used cognitive presence in this study to facilitate the analysis of students' posts so that I could examine the relationship between the quality of their posts and the application of the assessment for learning process.

The following hypotheses and research questions guided this study.

RQ: Does implementation of an assessment for learning approach in the design and facilitation of an asynchronous discussion result in significant differences in cognitive presence messages among high school students during the asynchronous discussions?

H_{01}: There is no significant difference in cognitive messages during the asynchronous discussions.

H_{a1}: There is a significant difference in cognitive messages during the asynchronous discussions.

SQ1: When instruction does not include assessment for learning, what levels of cognitive presence messages are evident?

SQ2: When assessment for learning is applied, what levels of cognitive presence messages are evident?

SQ3: What change in teachers' teaching presence is evident during the asynchronous discussions?

SQ4: What relationship exists between changes in teaching presence and cognitive presence between the asynchronous discussions within each group?

H_{01}: There is no relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

H_{a1}: There is a positive relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

H_{a2}: There is a negative relationship between changes in teaching presence and cognitive presence between the asynchronous discussions within each group.

In this chapter, I report on the process of this study and the results I garnered. First, I describe the process of data collection and align it with the procedures outlined in Chapter 3 to highlight changes that were necessary as a result of data collection. In this first section, I describe the actual sample and discuss issues that arose during data collection. In the next section, I describe the treatment and how I aligned what actually occurred with what I had planned in the research proposal. I then shift focus to report on the statistical analysis that I conducted. I explain the analysis with respect to the research questions and note why modifications to the planned analysis were necessary. Finally, I conclude the chapter with a summary that introduces the issues that I explore in Chapter 5.

Data Collection

Sample

During data collection, 41 students were registered in both sections of the Modern World History course that provided the context for this study. Participation in both discussions was high, with 93% of all discussants posting to the discussions. The number of discussants remained consistent for both groups across both discussions. This may be due to the fact that the discussions were class assignments and students were obligated to complete them as part of their daily learning. The data was taken from a class assignment that was assigned to the entire group. All discussants were focused on the same historical periods and topics. The discussions spanned the period between November 18, 2015 and January 7, 2016. Within that time period, there was a four day break for Thanksgiving and a fourteen-day break for the Christmas holidays. During the period between pre and

post discussions, the treatment teacher reviewed the professional development material and accessed the services of an assessment for learning expert as the teacher developed the next lesson. Though discussions occurred online within the periods indicated, it is important to note that this was a blended environment, and that other complementary instruction was delivered in both classes before and after each discussion.

The discussants in this study were enrolled in City High School. CHS is part of a group of schools that I refer to as the Network. The Network comprises 30 schools nationwide with approximately 10,000 students. The discussants compare similarly to the demographic makeup of students across the Network. Of the 41 participants in this study, 96% were students of color. Throughout the Network, 97% of the student body is students of color. The Network schools are guided by similar missions to serve specific populations of inner city residents. As such, all students attending Network schools fit within the SES bracket for families earning no more than $35,000 annually. Altogether, slightly more (58%) of the discussants were female. However, there were also more female students (57%) than male students (43%) throughout the school.

Procedure

Participants in this study engaged in two asynchronous discussions, as planned. The discussions were supposed to be open for two weeks each. However, teachers from both the control and treatment groups determined that they needed to hold the discussions open for more than three weeks each. This was because the quarter and semester were drawing to a close, and there was a desire to give students every opportunity to boost their grades. Both groups were covering the same topics at the same time and used many

of the same supporting resources. There were two discussions: an initial discussion on the theme of European explorers that functioned as the pretest, and a second discussion on Christian religions that functioned as the posttest.

The discussions were conducted within the school's Moodle environment. I copied and pasted transcripts into documents, and then constructed a table to record discussant names and corresponding aliases to anonymize the participants. I then adjusted the transcripts to show the discussants' aliases instead of their actual names. I next broke the transcripts into sentences and copied those into a spreadsheet with the corresponding columns for the sentence type: Triggering, Exploration, Integration, and Resolution. Beneath each sentence was a row that coders could use to record their rationale or justification for a particular code if they felt it was necessary. I provided coders with the anonymized transcript, which also contained the discussion prompt and the spreadsheet. One tab on the spreadsheet contained the sentences and columns for cognitive presence. Another tab contained descriptors for each level of cognitive presence as a reference for the coders. I instructed the coders to code in isolation.

When the coders were finished, I reviewed the codes and accepted codes that were unanimously recorded. Any code that differed among coders was discussed at a meeting and resolved by majority rule. Rationales recorded at the time of coding were very helpful in clarifying what each coder felt during his or her first look. At the meeting, I created a new spreadsheet with a separate tab for each coder's codes. A final tab contained copies of each set of codes without the corresponding sentences. I changed the final set of codes to reflect the decisions we arrived at during the meeting. The final set of

codes on that tab therefore became the raw data for the occurrence of each level of cognitive presence. I followed this procedure for both the pre- and posttest discussions.

Unfortunately, the timeframe for coding the transcripts extended beyond the time the teachers needed to grade the discussions. Therefore, both teachers graded the transcripts without the benefit of the coding. Because of this, the only data I collected was the count data of the incidence of the different levels of cognitive presence. Instead of numerical data that could have been used to calculate means, I had to use categorical data for the study. Gorsky et al. (2012) used chi-squared analysis when they conducted a quantitative content analysis examining cognitive presence to determine the impact of using sentences as opposed to messages for the unit of analysis. In that study, the researchers also analyzed categorical counts of data. Therefore, instead of using ANOVA and ANCOVA analyses, which require numerical data, I used the chi-squared test for independence in this study to analyze the data. This test was adequate to the task of answering the research questions.

McHugh (2013) listed six main assumptions necessary for the use of chi-squared tests. The first called for count data to be analyzed. As stated above, the data I yielded for this study were counts of cognitive presence statements. Second, each category of variable should be discrete so that an entry can only belong under one category. In this study, four categories of cognitive presence were discrete so that no statement was coded soas to belong under two categories. Third, the groups studied must be independent of each other. In this study, the two groups of discussants were separate and did not mingle within the assignments or receive the same instruction. Fourth, two variables must be

measured at the categorical level. The analysis used in this study looked at time with respect to the implementation of the assessment for learning process and cognitive presence. I examined each level of cognitive presence independently. Fifth, when a *2x2* table is used to set up the chi-squared analysis, no cell should have less than 5 cases. In the results section, cross-tabulation tables show that no cell had less than 5 cases. Finally, different subjects should be tested at different times so that no subject appears identically in more than one cell. In this study, I studied two groups over two time periods. These six assumptions were valid for this study and supported my choice of chi-squared analysis as the appropriate method of data analysis.

Results

Background

While 41 discussants participated in this study, the more significant number is that of the posts made by the students. The unit of analysis in this study is the sentences making up the posts from the 41 discussants. Altogether, 892 sentences were coded and analyzed during this study, as represented in Table 4. I chose sentence level analysis for this study because, as Billet (2012) noted, it was likely to yield a large count of data for analysis. (See Table 4).

Table 4.

Distribution of sentences across levels of Cognitive Presence

Sentences	Triggering	Exploration	Integration	Resolution
Group G Pre	50	85	6	9

Group G Post	47	87	32	8
Group H Pre	59	199	82	8
Group H Post	11	113	66	30
Total/Presence	167	484	186	55
Total Sentences			892	

Having a large count of data for this analysis was important because of the type of analysis that I completed. The main assumptions for a chi-squared analysis are that the variables involved are categorical in nature, and that when a table is constructed representing the data, each cell containing possible combinations will have more than five possible outcomes.

These assumptions were satisfied in this study. The samples were not entirely random because the study was conducted within an existing school environment. However, the assignment of students to the classes that made up each of the groups participating in this study was entirely random. Neither one of the two classes was the result of any type of academic tracking or placement test. The course is a college preparatory course which is common throughout the school. While there are AP classes taught in the school, all other courses are either college preparatory or honors. The data analysis returned no possible combination of cases that were less than five.

The data analysis conducted in this study looked at each category of cognitive presence for each group at each time period. Therefore, all triggering type sentences were analyzed together; all exploration type sentences were analyzed together, as were all integration and resolution type sentences. This approach allowed a deep analysis of the

trends of the discussions and provided an opportunity to estimate the level of independence among the different types of cognitive presence statements.

Analysis

The overarching research question focused on whether implementing an assessment for learning approach in the design and facilitation of an asynchronous discussion result in significant differences in cognitive presence messages among high school students during the asynchronous discussions. Analysis revealed that there were significant differences among the types of cognitive presence statements and between the pre- and post-test application. Among triggering, exploration, and integration type statements, each had a $p < .01$. Among resolution type statements, the confidence level was $p<015$. Therefore, it is reasonable to reject the null hypothesis that there is no relationship between cognitive presence statements and the implementation of an assessment for learning approach.

While *p* values suggested that there was a significant difference among the types of cognitive presence statements between the pre and post-tests, it is necessary to take a closer look at the analysis results to ascertain a fuller perspective with respect to the differences that were observed. Cross tabulation tables were useful in indicating exactly where expected results in terms of frequencies of specific types of cognitive presence statements varied within groups, between groups, and between the pre and post tests. The cross tabulations were informative and useful for answering research sub questions 1 and 2. These questions focused on the levels of cognitive presence statements that were

present with the implementation of the assessment for learning process and in the absence of the process.

With respect to triggering type statements, the differences between the expected and actual counts were mixed. As Table 5 shows, among discussants in the treatment group, (H), the difference between the expected count of triggering type statements and the actual count widened after the implementation of assessment for learning. Triggering type statements are the lowest level of cognitive presence statements, and it is possible that after the implementation of the assessment for learning approach, discussants would have used more of their sentences making statements that were coded at the higher levels of cognitive presence. (See Table 5).

For Group H, the expected count of triggering type statements prior to the implementation of the assessment for learning approach was 22% less than the actual count of triggering statements posted by students, suggesting that discussants' triggering type statements exceeded what was statistically expected of that group. However, after the implementation of the assessment for learning approach the expected count of triggering type statements was 53% greater than the actual count for such statements. While this may not indicate that the assessment for learning approach is related to increased higher level cognitive presence statements, it does suggest that after the assessment for learning approach, students in Group H posted fewer than expected triggering statements (compared to a random distribution of such statements). Among discussants in Group G, the converse was true. Triggering level statements in the first

discussion were more than were expected and, during the second discussion, less than expected if the frequencies were random. (See Table 5).

Table 5.

*Group * Triggering Statement Cross tabulation*

			Trigg_Post		
			Pre	Post	Total
Group	G	Count	50	47	97
		Expected Count	63.3	33.7	97.0
		% within Group	51.5%	48.5%	100.0%
		% of Total	29.9%	28.1%	58.1%
	H	Count	59	11	70
		Expected Count	45.7	24.3	70.0
		% within Group	84.3%	15.7%	100.0%
		% of Total	35.3%	6.6%	41.9%
Total		Count	109	58	167
		Expected Count	109.0	58.0	167.0
		% within Group	65.3%	34.7%	100.0%
		% of Total	65.3%	34.7%	100.0%

Table 6 shows a similar situation with respect to the next level of cognitive presence statements, exploration. For Group H the expected count was 10% less than the actual count of exploration type statements before the implementation of the assessment for learning approach. After the implementation of the assessment for learning approach, the expected count of exploration type statements was 12% greater than the actual count for such statements. In Group G, the expected count during the first discussion was 15% higher than the actual count, and during the second discussion, the expected count was 18% less than the actual count. These results also suggest that the actual frequencies were different than what would be expected if they were random. (See Table 6).

Table 6.

*Group * Exploration Statement Cross tabulation*

			Expl_Post		
			Pre	Post	Total
Group	G	Count	85	87	172
		Expected Count	100.9	71.1	172.0
		% within Group	49.4%	50.6%	100.0%
		% of Total	17.6%	18.0%	35.5%
	H	Count	199	113	312
		Expected Count	183.1	128.9	312.0
		% within Group	63.8%	36.2%	100.0%
		% of Total	41.1%	23.3%	64.5%
Total		Count	284	200	484
		Expected Count	284.0	200.0	484.0
		% within Group	58.7%	41.3%	100.0%
		% of Total	58.7%	41.3%	100.0%

A similar situation exists with respect to integration type statements. Table 7 shows that within Group H, the expected count of integration type statements was 15% less than actual count and the expected count for integration type statements after assessment for learning was implemented was 15% higher than the actual count. The converse was true for Group H where the expected count of integration statements was 67% greater than the actual count during the first discussion and the expected count was 38% less than the actual count. With respect to integration type statements, the frequencies of the integration type statements were again different from what would be expected if they were random. (See Table 7).

Table 7.

*Group * Integration Statement Cross tabulation*

			Integ_Post		
			Pre	Post	Total
Group	G	Count	6	32	38
		Expected Count	18.0	20.0	38.0
		% within Group	15.8%	84.2%	100.0%
		% of Total	3.2%	17.2%	20.4%
	H	Count	82	66	148
		Expected Count	70.0	78.0	148.0
		% within Group	55.4%	44.6%	100.0%
		% of Total	44.1%	35.5%	79.6%
Total		Count	88	98	186
		Expected Count	88.0	98.0	186.0
		% within Group	47.3%	52.7%	100.0%
		% of Total	47.3%	52.7%	100.0%

Finally, counts for resolution type statements were also different from the expected counts. Table 8 shows the frequencies and differences among expected and actual frequencies of resolution level statements. What is noteworthy in Table 8, however, is the fact that for the first time, actual counts of statements during the second discussion among Group H discussants was higher than the expected count.

An examination of Tables 5-8 illustrate that there were differences among the actual and expected counts for the different types of statements indicating cognitive presence. It reflects the conclusion that there were significant differences among the incidence of statements for all types of statements of cognitive presence. A pattern seemed to prevail, where for Group G, expected counts were greater than actual for the

first discussion and less than actual for the second discussion. This situation prevailed until the final type of statement, resolution. Similarly, a converse pattern existed for Group H, where expected counts of the different types of statements for the first discussion were less than the actual, and greater than the actual for the second discussion. Again this persisted until the final type of statement, resolution where the expected count was greater than the actual for the first discussion but the expected count was less than the actual for the second discussion. (See Table 8).

Table 8.

*Group * Resolution Statement Cross tabulation*

			Reso_Post		
			Pre	Post	Total
Group	G	Count	9	8	17
		Expected Count	5.3	11.7	17.0
		% within Group	52.9%	47.1%	100.0%
		% of Total	16.4%	14.5%	30.9%
	H	Count	8	30	38
		Expected Count	11.7	26.3	38.0
		% within Group	21.1%	78.9%	100.0%
		% of Total	14.5%	54.5%	69.1%
Total		Count	17	38	55
		Expected Count	17.0	38.0	55.0
		% within Group	30.9%	69.1%	100.0%
		% of Total	30.9%	69.1%	100.0%

Tables 5-8 also provide insight into the distribution of cognitive presence statements across the first and second discussion that is useful for this analysis and offer a response to research questions 1 and 2. As can be seen in Figure 1, between discussions 1

and 2, Group H discussants' statements seem to be shifting from the lower level triggering type statement to the higher level resolution type statement. Discussion 2 is characterized by fewer lower level statements and higher level statements.

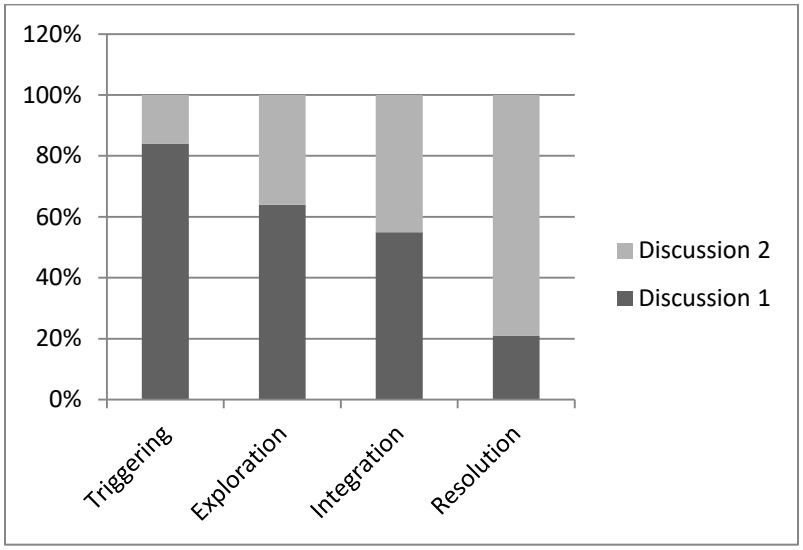

Figure 1.
Changing percents/cognitive presence statement types Group H

As discussants in Group H are posting an increasing number of higher level posts in discussion 2 as opposed to discussion 1, the proportion of higher level cognitive presence statements is also increasing vis-à-vis lower level cognitive presence statements across discussions. Figure 2 shows that resolution cognitive presence statements make up a greater percent of total discussion 2 statements and triggering cognitive presence statements make up a smaller percent of discussion 2 statements when both are compared to discussion 1 statements. While triggering statements made up 17% of Group H discussants' cognitive presence statements in discussion 1, they made up only 5% of cognitive presence statements in discussion 2. In discussion1 Group H discussants' resolution statements were 2% of cognitive presence statements, they were 17% of

cognitive presence statements in discussion 2. The results suggest that the implementation of the assessment for learning process was related to the shifting of statements made by discussants to higher levels of cognitive presence.

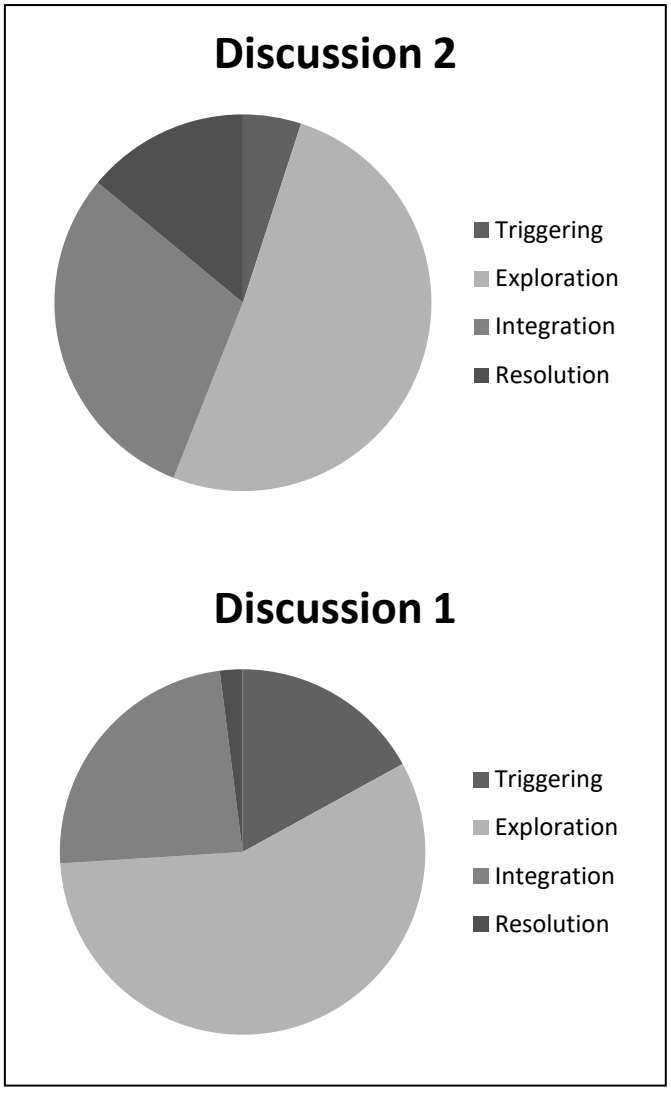

Figure 2.
Changing distribution/cognitive presence statements between discussions

Conversely, no similar transformation was apparent in Group G with respect to the different types of cognitive presence statements across discussions. Unlike with Group H, Figure 3 does not indicate a movement towards higher level cognitive presence

statements during discussion 2. Except for integration level statements, little difference was apparent between the proportions of cognitive presence statement types between discussions.

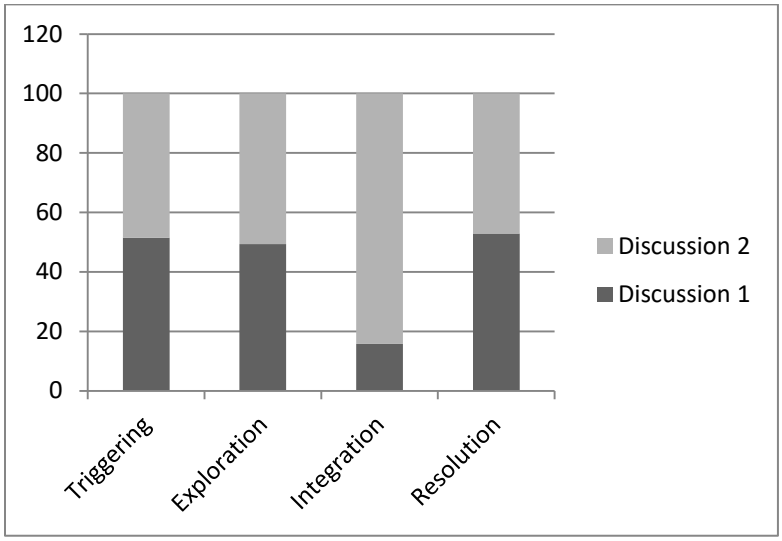

Figure 3.
Changing percents/cognitive presence statement types Group G

With respect to research sub questions 3 and 4, there was insufficient data to analyze teacher presence. Across both groups and time periods, teachers within the discussion forum made only three statements. Therefore it is not possible to ascertain whether there was any impact on cognitive presence due to teacher presence. It may even be defensible to say that since there were so few statements by teachers, three as compared to 892 by students, there was minimal impact on the levels of cognitive presence by the occurrence of teacher presence within the discussion forum. Apart from teacher presence, there are other areas where the data indicates shortcomings in the application of the CoI model or the assessment for learning approach which may help to explain some of the results.

In Group G, students were not given learning goals as part of either discussion prompt. It is likely that some type of learning goal was given, as it is the instructional policy of the school to post a learning goal in the classroom before instruction. However, if the learning goal was posted in the classroom, it would be separated from the discussion itself and may have encouraged the perception that the discussion was an activity or test that followed the day's instruction. Both discussions for Group G included a guiding document that outlined expectations for the discussions. Both guiding documents described an activity type interaction. For discussion 1, the document stated, "Your task is …. ." (Appendix H). For discussion 2, that guiding document stated, "Students will be writing a letter …." (Appendix H). In neither case was there clear mention of a learning goal, but instead definitive directions with respect to completing a task. The discussion prompts in Moodle also did not feature a stated learning goal but did give directions as to where different types of comments should be posted "Use this forum to discuss ….." (Appendix H).

In Group H, the prompt for the initial discussion was very similar to the prompts used in Group G. For discussion 1, there was direction that stated where to post what "Use this forum for our week-long discussion ….." Appendix H. Again, it is likely that there was also a learning goal posted in the classroom during the assignment of the discussion, but none appeared as part of the forum itself. Again, there was a guiding document, but it also referenced a task "Your task is to develop a definition ….." (Appendix H). For discussion 2, however, the discussion prompt did include a learning goal signaling that the discussion itself was part of the instructional process and not

simply an assessment. The learning goal stated that “Students will be able to evaluate evidence and debate best responses to exam essay prompt question by engaging in online discussion” (Appendix H). This use of the learning goal signals that the discussion was intended to be part of the learning process in advance of an upcoming assessment. Also, the learning goal indicated that students were at the center of the activity. The onus was on students to arrive at an effective response to an upcoming summative assessment. By stating that students were to “debate best responses”, the learning goal emphasized a student centered as opposed to a teacher centered approach.

All discussions benefitted from the provision of success criteria. The guiding documents gave specific instructions with respect to what should be posted, when posts should be made, and how long posts should be in order for them to meet expectations. They also explained the expectation for students to respond to other students, thereby promoting peer feedback. However, discussion 2 for Group H also benefitted from a reflection on success criteria as it related to quality of the posts themselves. The teacher used the space between discussions to review the initial discussion and point out where deeper thinking should have happened. While this was not part of the discussion prompt, the process of reflection would have helped students understand that their posts should be the result of deep thinking. This type of activity would have undoubtedly helped students aim for the type of posts that would fall within the categories at the higher levels of cognitive presence.

One area where all discussions fell short of both the assessment for learning process and the expectations for effective learning, according to the community of

inquiry model, was in the provision of teacher feedback. Only in discussion 2 for Group H was there an attempt to offer teacher feedback. On the one hand, this suggests that the observation of the other attributes of the assessment for learning process may have been particularly potent, since the findings show a positive impact without many instructor posts offering feedback. On the other hand, many threads of thought during the discussions, especially ones that made it to the integration level, may have encouraged students to post more resolution type statements had the instructors entered the discussions to ask more probing questions.

Summary

This study examined the incidence of different levels of cognitive presence statements in asynchronous discussions when the assessment for learning process was utilized to guide the design and facilitation of the discussion. The main research question posed focused on whether there was a significant difference in the levels of cognitive presence statements when the assessment for learning process was utilized. Chi-squared analysis was used to analyze the data, and the results indicated that there were differences with respect to the different levels of cognitive presence statements when the assessment for learning process was used. The confidence levels generated from the analyses were $p<.001$ and $p<.05$.

The first two sub questions focused on whether there was any difference in the levels of cognitive presence statements when the assessment for learning process is utilized and focused attention on a close examination of the differences among levels of cognitive presence statements when the assessment for learning process was utilized. The

cross tabulations yielded bountiful data demonstrating that the treatment group transitioned to higher levels of cognitive presence statements when the assessment for learning process was utilized. The control group had a relatively flat incidence of the various levels of cognitive presence statements. Except for the integration level, levels of triggering, exploration, and resolution type statements remained fairly equal during the second discussion. On the other hand, with respect to Group H, the treatment group, there was a clear pattern of smaller proportions of lower level cognitive presence statements after the assessment for learning process was applied and greater proportions of higher level cognitive presence statements when the assessment for learning process was applied.

Research questions 3 and 4 focused on the levels of teacher presence as a way to determine whether there may have been another reason for any change in the levels of cognitive presence statements that may have been seen. The questions posed focused on whether there was a relationship between the level of teacher presence and the levels of cognitive presence statements. There was not enough data to evaluate the level of teacher presence in the discussion because teachers only contributed three statements to the discussion as opposed to the 892 statements contributed by students. However, it should be assumed that the small number of teacher statements indicate a minimal impact on the levels of cognitive presence statements.

An analysis and interpretation of these findings will follow in the next chapter. It is apparent that the results indicate some usefulness for the assessment for learning approach in the design and facilitation of an asynchronous discussion. Specific statements

will be examined to illuminate the progression of the discussion and the incidence of the different levels of cognitive presence statements. This analysis and interpretation will be framed within the limitations to the generalizability of this study. There will also be a discussion of issues that arose during the study and comments made with respect to the possible impact, if any, on the reliability and validity of the study.

Finally, implications for social change and recommendations for further study will be discussed. These two aspects of this study are complementary as any opportunity for positive social impacts will only be strengthened when gaps in this research are closed and questions arising out of this study have been addressed.

Chapter 5: Discussion

Introduction

I undertook this study to investigate the different levels of student cognitive presence when the assessment for learning process was fully applied to the instruction received by students. The goal was to determine whether or not there was a relationship between the incidence of cognitive presence statements in an asynchronous discussion and the application of the assessment for learning process. Three factors compelled me to undertake this study. The first factor was Black and Wiliam's (1998) observation that the assessment for learning process is particularly helpful for lower-achieving learners. Unfortunately, much of the literature on assessment for learning focuses on individual attributes, not the entire process. This gap was the second factor. Finally, online learning has been expanding in the K-12 sector, and there is a need to ensure that younger learners are well served by this model. These factors served as my rationale for examining whether or not the assessment for learning process could enhance learning among K-12 students.

The results of this study indicated that there was a significant relationship between the incidence of the different levels of cognitive presence statements and the implementation of the assessment for learning process. Also, when the assessment for learning process was applied to the design and facilitation of the asynchronous discussion, discussants posted a greater proportion of higher-level cognitive presence statements. Specifically, the findings indicated that when the assessment for learning process was applied to the design and facilitation of the asynchronous discussion, the

distribution of sentences among the various levels of cognitive presence was inversely related to the distribution of sentences among the various levels of cognitive presence when the assessment for learning process was not applied. After the assessment for learning process was implemented, lower-level cognitive presence statements decreased and higher level cognitive presence statements increased. Findings regarding the levels of teacher presence were inconclusive due to a paucity of data.

Interpretation of Findings

Alignment

There is some alignment between the findings of this study and what has been claimed in the scholarly literature. Research cited in this study has indicated that formative assessment has a positive impact on students' learning and achievement (Black & Wiliam, 1998, 2001; Hodgson & Pang, 2012; Hung et al., 2010; Hwang & Chang, 2010; Kibble et al., 2014; Lawton et al., 2012; Moss & Brookhart, 2009; Voelkel, 2013; Weurlander et al., 2012). In this study, I focused on the deep thinking, cognitive presence which signals that learning is taking place. The findings of the study showed that after the formative assessment was implemented, students participated in the asynchronous discussion with a greater proportion of statements at the higher level of cognitive presence.

There is a significant difference between this study and previous studies regarding the implementation of formative assessment in the online space, inasmuch as I addressed formative assessment as a process and not one or two strategies aimed at increasing engagement, managing feedback, or assessing understanding. In this study, the

professional development materials that informed the design and implementation of the second discussion by the teacher of Group H treated formative assessment as a *process* that merged all attributes into an interrelated set of behaviors. Therefore, there were marked differences in the ways in which the discussions were designed and facilitated in this study (see Table 9).

The provision of learning goals was markedly different between groups and discussions. As I demonstrated in Chapter 4, the experience for discussants in Group G would not have been very different from other studies where formative assessment is treated as a test or activity. The same can be said of the first discussion for Group H. Discussion 2 for Group H, however, did utilize the kind of learning goal statement that communicated to students that the discussion was going to be a learning experience, not really an assessment, and that their participation would be central to the success/quality of the discussion. A student-centered approach and a learning goal that focused students on their learning were two critical aspects of the implementation of the assessment for learning process in Discussion 2 for Group H.

Teacher use of success criteria, an attribute of the assessment for learning process, was consistent throughout all discussions. The guiding documents provided to students to frame the details of their discussion communicated to them the behaviors necessary to achieve success. However, Discussion 2 for Group H included the success criteria as well as an opportunity for self-assessment, two attributes of the assessment for learning process. The teacher's decision to use the result of the initial discussion as a way to explain where expectations were not met allowed each discussant to reflect upon their

statements as part of the broader discussion. Therefore, discussants in Group H had the opportunity to consider and be guided by a learning goal, take ownership of the quality and success of the discussion, and reflect upon their initial efforts and compare them to a given success criteria.

Both the assessment for learning process and the community of inquiry model include a role for teachers. However, none of the discussion prompts featured significant teacher presence. Discussion 2 for Group H did have minimal teacher presence in the discussion, but the teacher also provided feedback between the discussions. The blended nature of the course allowed for the provision of teacher feedback outside of the discussion forum. Therefore, Discussion 2 for Group H featured a full implementation of the assessment for learning process.

Table 9.

Assessment for learning Attribute Alignment within Discussions

Discussion	Student Centered	Learning Goal	Success Criteria	Teacher Feedback	Peer/Self Feedback
Group G D1	No	No	Yes	No	Yes
Group G D2	No	No	Yes	No	Yes
Group H D1	No	No	Yes	No	Yes
Group H D2	Yes	Yes	Yes	Some	Yes

The second discussion for Group H featured more attributes of the assessment for learning process than all other discussions. The implementation of the assessment for learning process did include more of the attributes than other discussions, though teacher feedback occurred mostly outside of the forum. This was likely due to the fact that the

time between the professional development experience for the teacher of Group H and the second discussion was very short. The teacher worked to implement the process, but was clearly still in the early stages of learning with respect to assessment for learning. Indeed, recent research has continued to indicate that assessment for learning is still being examined as a set of individual strategies (Baleni, 2015; Kesianye, 2015; Klimenko & Sleptova; Tebeje & Abiyu, 2015; Umer & Omer, 2015). When researchers have looked at assessment for learning as a process in keeping with the work of Black and Wiliam (1998, 2001), they have demonstrated that teachers sometimes struggle to implement the process fully (Lysaght, 2015). Therefore, it should not be surprising that a teacher's first attempt to implement the process may be uneven.

While recent researchers have still approached assessment for learning/formative assessment as a collection of individual strategies, there has been a greater appreciation of its complex nature. Baleni (2015), Kesianye (2015), Klimenko and Sleptsova (2015), and Lysaght (2015) have all discussed assessment for learning/formative assessment as both ongoing and a process. However, while Baleni (2015) acknowledged the process, his examination is still focused on testing and feedback. Klimenko and Sleptsova (2015) also emphasized a test focused, teacher driven practice. Kesianye (2015) discussed three perspectives of assessment and noted assessment for learning as a process that can impact student learning, but again focused primarily on testing and feedback. In their recent work, Tebeje and Abiyu (2015) did not discuss a process, but focused on formative assessment as a type of test yielding opportunities for feedback. Similarly, Umer and

Omer (2015) juxtaposed formative assessment against summative assessment in order to discuss the benefit of feedback as part of formative assessment.

Theoretical Alignment

Black and Wiliam's (1998, 2001) work provided a theoretical grounding for my study. They have suggested that assessment for learning positively impacts student achievement, especially among lower-achieving students. Black and Wiliam's rationale is that placing students at the center of their learning by setting up a process that guides their involvement in the construction of their own learning strengthens those students who are not yet competent in guiding their own learning. In this study of formative assessment and asynchronous discussions, I did not examine student achievement; therefore I cannot make claims about whether assessment for learning promoted greater achievement. I did focus on cognitive presence, which provides a way, through content analysis, to gauge students' thinking as they engage in the process of learning. There is a connection between learning and achievement, but other constructs like motivation may play significant roles in determining levels of student achievement.

My study of formative assessment and asynchronous discussions did have a conceptual grounding as well. It was framed by a constructivist orientation that relied upon the work of Dewey (1938) and Vygotsky (1934/2012). That orientation was critical, because it informed my argument that a full implementation of the process is necessary for student academic achievement. The literature on assessment for learning reveals a singular focus on aspects of assessment for learning. Feedback, testing and questioning, and learning goals are all attributes that researchers have focused on as critical aspects of

assessment for learning/formative assessment. Student-centered approaches are less tangible and not as common in the literature. In this study, I paid particular attention the central role of students in the review of the literature and in the implementation of the treatment.

The findings of this study indicated that implementing the assessment for learning process, even when it was uneven, was related to increased levels of cognitive presence statements during the discussion. Cognitive presence is the cognitive engagement of students with the learning community. The learning community includes the resources provided by teachers and peers and the feedback of teachers and peers. In short, cognitive presence is thinking about the content while considering the input of other members of the learning community. Akyol and Garrison (2011) noted that students may demonstrate increasingly sophisticated levels of engagement as indicated by the progressively higher levels of cognitive presence. At higher levels of cognitive presence, students have the potential to explore content in deeper ways and to learn more effectively. In the absence of other constructs confounding levels of achievement, it conclude that in this study, the increased levels of cognitive presence statements would positively impact students' achievement. In this regard, I view assessment for learning as having a positive impact on student achievement.

Another important aspect of this study was the level of student ownership of learning, as evidenced by strategies that promote students taking a central role in the learning process. Of the four discussions, only the second discussion of Group H included an orientation that framed the activity as one in which students were to take a

central role in determining what was an appropriate response to an upcoming assessment given the material learned, resources provided, and comments of peers and teacher. The teacher of Group H in the second discussion charged the students through the learning goal statement with coming up with and debating the best answer. The teacher did not provide the answer but provided support in terms of resources and the frame of a discussion to release students so that they may explore and mull over possible best answers to a question. If students are to rise to such a challenge, they must go beyond the resources provided and offer evaluations, justifications, and critiques so that they may distill an appropriate answer from the resources. The findings of this study showed that students' responses after the implementation of the assessment for learning process indicated a greater proportion of statements devoted to higher levels of cognitive presence. These higher levels are where students break out of the given and begin to evaluate, justify, and critique. Therefore, it can be stated that student ownership was a key feature of this study and must be positively related to student cognitive presence levels and indirectly to student achievement, given the absence of other constructs that may hinder achievement.

Limitations of the Study

Generalizability

This study utilized a sample from a specific population of high school students. The school is part of a network of schools that prescribes the SES characteristics of its students. Students in this study all belonged to families within a certain income bracket. They resided within the limits of the City. As a result, this study is not generalizable to

more diversely SES populated schools. It is not generalizable to schools in suburban or rural areas where the populations may be different and more diverse. Additionally, this study occurred within a blended environment. The students attended school in a brick and mortar setting. Though they may have competency with online tools due to policies at the school, and the need to extend learning beyond the school's walls due to the work-study component, these students did not have the same competence with online learning tools as students who may be attending virtual high schools where the learning is primarily conducted online. Their proficiency with using asynchronous discussions to explore concepts and tendency to reach higher levels of cognitive presence may be less than those of students in fully online programs or courses. Therefore, the study is not generalizable to students enrolled in fully online courses or high schools.

Validity

As discussed in Chapter 3, there are some threats to the validity of this study. While most have been addressed through the methodology or the particular characteristics of this study, one remains of concern. The study was conducted with a rich bounty of raw data. This is due to the fact that analysis was conducted at the sentence level. However, behind the large number of statements analyzed was a relatively small convenience sample. Altogether, only 41 students were available to participate in this study. While the possible population numbered more than 120, only discussants belonging to two sections were studied. While the selection of discussants was not random, the research procedures did approach randomness. Students were assigned to sections on a purely random basis. Also, the choice of sections was related only to any

sections that were at the same point in the course. This characteristic would change as the year proceeds, but it did not occur during the course of the discussions.

Reliability

Data was analyzed using a tool constructed by Shea et al. (2013); however, there was still a degree of subjectivity involved in the coding of discussants' statements. The scale developed by Shea et al. is comprehensive and provides definitions and indicators, but there is still room for interpretation. In this study, a panel of three coders coded each statement using the Shea tool for guidance. Discrepancies among coding scores were resolved at meetings among the coders. During the process of coding, coders were required to provide a rationale for some codes. This procedure helped to ensure that the coding was consistent across the study. However, it is possible that others may use the Shea tool, and it is possible that their interpretation of students' statements may be different.

Recommendations

This study was hindered by three main limitations and weaknesses. First, the study has limited generalizability. Because of the nature of the school's enrolment policy, only certain students who fall within specific demographic parameters were examined in this study. This meant that enough could not be reliably extrapolated to other high school students. Chapter 2 explained that online learning is expanding among the K-12 sector (Picciano & Seaman, 2009). This sector includes students of various demographic characteristics. If the promise of a full implementation of the assessment for learning process is to be evaluated fully, broader populations must be studied.

The implementation of the assessment for learning process was also a source of weakness. It was intended in this study to examine a full implementation of the assessment for learning process, but the treatment teacher was not able to incorporate all elements such that they could be accounted for during the discussions. Lysaght (2015) noted that teachers struggle with mastering implementation of the assessment for learning process. It may be necessary to account for teachers' developing expertise with implementing the full assessment for learning process in order to truly explain the impact of assessment for learning on students' learning.

Finally, content analysis proved to be an effective way to reveal students' developing thinking processes with respect to the content of the course. However, the tool used in this study does require a degree of subjective determination to classify students' statement according to the different levels of cognitive presence. Also, Black and Wiliam (1998) made the claim that assessment for learning/formative assessment positively impacts student achievement. This study did not focus on achievement but cognitive presence with the hope of making connections to achievement. However, if achievement is to be measured when assessment for learning is fully implemented, there needs to be an effort to incorporate student achievement scores, in addition to levels of cognitive presence.

Additional study of the impact of assessment for learning is necessary and should include new enquiries and methodologies. Future studies of the impact of assessment for learning on student learning in the online space should involve a broader sample including diverse populations. This will allow for greater generalizability to more high

school students. Broader generalizability is critical because there is a need to adjust online learning experiences for younger learners to make those experiences more suited to younger learners and effective (Baker, 2011; Borup, Graham, & Davies, 2013; Garthwait, 2014; Ozyurt & Ozyurt, 2013; Kazu & Demirkol, 2014; Kerr, 2011; McFarlane, 2013; Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013; Zhang, 2013). The tight alignment between community of inquiry and the assessment for learning attributes suggests that future studies should expand the focus beyond cognitive presence to include teaching presence, social presence, and learning presence (Shea et al., 2013). Doing so will provide the opportunity to gauge the impact of all of the important attributes of the assessment for learning process requiring a multivariate analysis of the various constructs. Future studies should also include opportunities for qualitative data collection, as well as quantitative data collection. A mixed methods approach will provide opportunities for clarification and verification of findings through triangulation of the data. In order to make valid statements about achievement, the quantitative aspect of the study could focus on students' test scores. The qualitative aspect of the study could offer opportunities for triangulation through interviews and content analysis

Implications

This study contributes to positive social change because it adds to the literature in a provocative way. It provides support for the argument that assessment for learning requires an attempt to incorporate and interweave all attributes in a continuous process that provides the opportunity for students to think more deeply and play a more significant role in their learning. The findings give rise to a need for further investigation

into assessment for learning and its impact on student learning. At the local level, CHS and the network to which it belongs acknowledge that assessment for learning has a positive impact on student learning. Indeed, many at CHS would argue that teachers at the school already practice assessment for learning. This study provides an opportunity for teachers to reflect on the findings and the literature referenced in this study that support a case for full implementation of the assessment for learning process, and to create opportunities to empower students to become more involved in their own learning. Doing so may strengthen students academically and boost their self-directedness such that the impact could be felt in their communities within the city.

There are also methodological implications for future study. This study focused on one aspect of the community of inquiry model while attempting to determine the impact of a complex process, assessment for learning, which incorporates multiple constructs. Future studies must take into account the various co-variables involved in studying assessment for learning and student achievement. Studying such a complex practice requires that researchers look at the constructs from various angles. The need for a mixed methods approach seems necessary to delve further into the nature of students' cognitive presence during asynchronous discussions.

Conclusion

The findings in this study show that there is reason to view the integration of the assessment for learning process into the design and moderation of asynchronous discussions as a type of new pedagogy (Fullan & Langworthy, 2014). Fullan and Langworthy (2014) described new pedagogies as an integration of digital tools and

student centered approaches that facilitate and promote deep learning and focus teachers' and students' attention on the process of learning so as to build a lifelong learning culture. The authors argued that when combined with new formats of educational leadership and economic initiatives, new pedagogies can have a revolutionary impact on teaching and learning.

This study featured an examination of the integration of the assessment for learning process and online discussions to see whether students were more cognitively engaged during the integration. One aspect of the study, the assessment for learning process, introduced elements like learning goals, peer feedback, and a focus on the process as opposed to the assessment. These elements appear to have empowered students to play a significant role in the learning by engaging with the concepts at a high level. Another aspect of the study, the community of inquiry model, facilitated the evaluation of different levels of students' cognitive presence during different teachers' instruction. The incidence of the highest levels of cognitive presence overwhelmingly occurred after one teacher attempted to fully implement the assessment for learning process.

While assessment for learning/formative assessment is consistently referenced in the literature as having a positive impact on student learning, the focus on a process instead of a type of assessment distinguishes this study from others in the knowledge base. Though the implementation of the assessment for learning process in this study was not perfect, the key feature of the implementation was the perspective that assessment for learning was a process not an assessment or event. This study's findings support the

positive impact that assessment for learning can have on student learning. However, it goes further to suggest that even when all attributes of the assessment for learning process are not equitably applied, approaching assessment for learning as a process that invites the active participation of students can have a significant impact on students' cognitive presence. Therefore, fully implementing assessment for learning in the online or blended space should be a priority for both researchers and practitioners.

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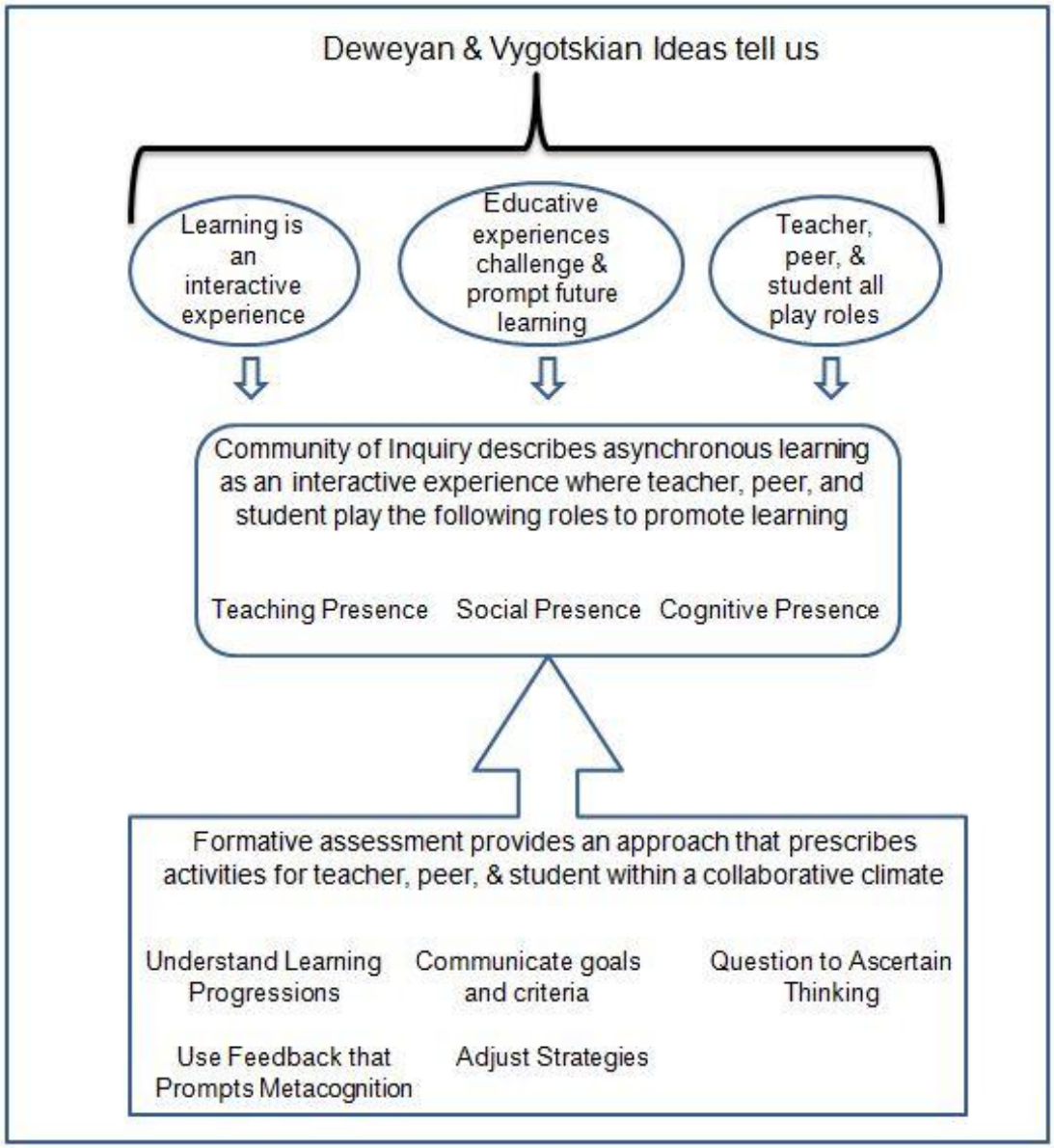
Appendix A: Deweyan and Vygotskian Alignment

Deweyan and Vygotskian Alignment



Appendix B: Dewey and Vygotsky Principles and AfL/CoI Alignment

Dewey and Vygotsky Principles and Assessment for learning/CoI Alignment

Deweyan & Vygotskian Constructivist Principles	**Assessment for Learning**	**Community of Inquiry**
Communication	Relies on constant effective communication among student, peer, and teacher	Explains how community and teacher interaction encourages cognitive engagement
Instructional leaders	Involves definite and critical roles for teachers	Notes that teachers have a unique role that results in student cognitive engagement
Thought/Reflection	Calls upon students and teachers to offer descriptive feedback and learners to ponder that feedback	Identifies reflection as an essential element of the community
Speech and writing	Requires students and teachers to use the speech or writing tools to ensure the interactions that move student's learning forward	Means for communicating within the community
Socialization	Involves a collaborative effort that helps all participants achieve better results (teachers and students)	Suggests that the sharing involved in community and teacher presence yields students' cognitive presence
Learner participation (active not passive learners engaging content)	Students have distinct roles and responsibilities to themselves and their peers to participate and add value to the learning experience	Community presence describes the active role students play in enriching learning experiences
Interaction	A process of interaction among learner, peers, and teacher	Interaction between community and teacher promotes cognitive presence

Deweyan & Vygotskian Constructivist Principles	**Assessment for Learning**	**Community of Inquiry**
Educative experiences	Involves the provision of learning goals and success criteria to anchor the learning experience and so ensure that students advance learning	The teacher's role is essential to providing the fuel that drives community presence in a direction that yields cognitive presence
Process of learning (zpd, spiral of learning)	Provides interconnected and value added stages that move students towards mastery and ownership of learning	Illustrates that an interactive process involving teacher and community action results in cognitive presence
Communication drives thought	Asynchronous discussions may demonstrate cognitive presence as learners reflect on the teacher presence and social presence of their peers	Asynchronous discussions may demonstrate cognitive presence as they respond to the products of teacher presence and feedback of their peers
Instructional leaders play important roles	Asynchronous discussions may provide the opportunity for learners to reflect on what and how they know	Asynchronous discussions may provide learners with the opportunity to manage their learning activities
Speech and writing are tools to produce interaction and learning	Used to communicate during the process	Used to communicate within the community
Learning occurs during the process of socialization	Relies on socialization around a collaborative culture	Uses a community of relationships to guide interactions
Learners and content to be learned are modified during the learning process	During the process adjustments to teaching and learning strategies are made	The learner engages with the content supported by the interactions within the community
Learning happens when students and content interact	Students are encouraged to reflect	Student/content interaction is the product of teacher and community presences
Learning experiences should move students to a new plateau of consciousness	Adjustments in learning strategies signal that students learning is progressing	Cognitive presence is more than the individual's ideas as they are influenced by the community and teacher presences

Appendix C: Survey Results (Baglione et al. 2011)

Survey Results (Baglione et al. 2011)

Hypotheses	**Results**
Faculty members who provide personal information during the first discussion believe they will enhance online and traditional classroom discussion performance.	Supported
Faculty members who explain the purpose and goals for the discussion believe they will have richer discussions online than in a traditional classroom.	Supported
Faculty members who establish guidelines on proper netiquette believe they will have richer online discussions.	Supported
Within a course, faculty members believe there will be a more equitable distribution of participation in online discussions than in traditional classroom discussions.	Supported
Faculty members believe asking students who dominate discussion groups to speak less will result in a more equitable distribution of participation among students in the online environment than in the traditional classroom.	Not supported
Faculty members believe learning is enhanced when discussion questions are matched to course level (for instance, introductory or upper-level) and to stage within a course (for instance, beginning, middle, or end) in either environment.	Supported
Faculty members believe participation among students and faculty is greater in the online environment than the traditional classroom because of anonymity.	Supported
Faculty members who begin discussion early in the semester using lower levels of Bloom's Taxonomy will generate greater participation in both environments.	Supported
Faculty members believe the online environment facilitates more substantive discussion than the traditional classroom.	Supported
Faculty members believe higher levels of facilitation in the beginning of the term enhance discussion performance in both online and traditional environments	Supported
Faculty members believe that through their facilitation of the asynchronous discussion, a virtual community will be developed by students interacting with each other.	Supported

Appendix D: Coding Scheme for Cognitive Presence (Shea et al. 2010)

Category	Code	Indicators	Defnintion	Revision Notes
Triggering Event	CP-TE-1	Recognize problem	Evocative (inductive) Stimulate one's curiosity	
	CP-TE-2	Sense of puzzlement	Core organizing concept or problem Dilemma or problem that learners can relate to from their experience or previous studies Framing the issue and eliciting questions or problems that learners see or have experienced Assessing state of learners knowledge and generating unintended but constructive ideas	
Exploration	CP-EX-1	Exploration within the online community	Inquisitive Understand the nature of the problem and then search for relevant information and possible explanation Group activities –brainstorming Private activities – literature searches Manage and monitor this phase of divergent thinking in such a way that it begins to be more focused	Replaced "Divergence" (Garrison et al. 2000) with "Exploration Replaced "Divergence" (Garrison et al. 2000) with "Exploration" Incorporated "Brainstorming" (Garrison et al. 2000) in this category
	CP-EX-2	Exploration within a single message		
	CP-EX-3	Information exchange		
	CP-EX-4	Suggestions for consideration		
	CP-EX-5	Leaps to conclusions		
Integration	CP-IN-1	Integration among groups members	Tentative Focused and structured phase of making meaning Decisions are made about integration of ideas Teacher must probe for understanding and misconceptions	Replaced "Convergence" (Garrison et al. 2000) with "Integration." Replaced "Convergence" (Garrison et al. 2000) with "Integration."
	CP-IN-2	Integration within a single message (response to prompt)		
	CP-IN-3	Connecting ideas, synthesis		
	CP-IN-4	Creating solutions		
Resolution/ application	CP-RE-1	Vicarious application to real world testing solutions	Resolution of the dilemma or problem Reducing complexity by constructing a meaningful framework or discovering a contextually specific solution Confirmation or testing phase may be accomplished by direct or vicarious action	

Appendix E: Coding Scheme for Teaching Presence (Shea et al. 2010)

Category	**Code**	**Indicators**	**Defnintion**
Design & Organization (DE)	DE1	Setting curriculum and communicating assessment methods to be used in the course	Communicates important course outcomes e.g. documentation of course goals, topics, rubrics, and instructor expectations
	DE2	Designing methods	Provides clear instructions how to participate in course learning activities, e.g. clear explanation of how to complete course assignments successfully
	DE3	Establishing time parameters	Communicates important due dates/timeframes for learning activities to help students keep pace with course, e.g. accurate course schedule
	DE4	Utilizing parameters	Assists students to take advantage of the online environment to enhance learning e.g. using LMS features for learning activities and resolving technical problems
	DE5	Establishing netiquette	Helps students understand and practice the kinds of behaviors that are acceptable in online learning e.g., providing documentation on polite forms of online interaction
	DE6	Making macro-level comments about course content	Provide rationale for assignment/topic
Facilitating Discourse (FD)	FD1	Identifying Areas of Agreement/disagreement	Helps to identify areas of agreement and disagrreement on course topics in order to enhance student learning
	FD2	Seeking to reach consensus	Assists in guiding class toward agreement about course topics in a way to enhance student learning
	FD3	Encouraging, acknowledging or reinforcing student contributions	Acknowledges student participation in the course, e.g. replied in a positive encouraging manner to student submissions
	FD4	Setting climate for learning	Encourages students to explore concepts in the course e.g., promotes the exploration of new ideas
	FD5	Drawing in participants, Prompting discussion	Helps keep students engaged and participating in productive dialog
	FD6	Presenting follow-up topics for discussion	Presents content or questions directly related to discussion
	FD7	Re-focusing discussion on specific issues	Helps focus discussion on relevant issues, keeps participants on topic
	FD8	Summarizing discussion	Reviews and summarizes discussion contributions to highlight key concepts and relationshps to further facilitate discourse

Direct Instruction (DI)	DI1	Providing valuable analogies	Attempts to rephrase/reformulate course material in ways that highlight similarities between content assumed to be understood and new content with the goal of making the material more comprehensible
	DI2	Offering useful illustrations	Attempts to make course content more comprehensible by providing examples that are substantive and advance understanding
	DI3	Conducting supportive and informative demonstrations	Attempts to make course content more comprehensible through the exhibition of processes
	DI4	Supplying clarifying information	Attempts to reduce confusion or misconceptions about course content by providing additional explanations
	DI5	Making explicit reference to outside material	Provides useful information from a variety of sources e.g., articles, textbooks, personal experiences, or links to external web sites. Must be something that can be retrieved (conference material is often archived or summarized, outside materials, etc.)
Assessment (AS)	AS1	Giving formative feedback for discussion	Explicitly evaluates discussion/offers feedback OR diagnoses misconceptions to help students learn
	AS2	Providing formative feedback for other assignments	Explicitly evaluates other assignment types/offers feedback OR diagnoses misconceptions to help students learn
	AS3	Delivering summative feedback for discussions	Provides post mortem feedback on discussions, including grades
	AS4	Supplying summative feedback for other assignments	Provides post mortem feedback on other assignments, including grades
	AS5	Soliciting formative feedback on course design and learning activities from students and other participants	Seeks feedback upon completion of modules or during mid-course
	AS6	Soliciting summative assessment on course design and learning activities from students and other participants	Seeks meta-level feedback at close of course

Appendix F: Assessment for Learning/Danielson Framework Alignment

Assessment for Learning/Danielson Framework Alignment

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Planning & Prep	Demonstrating Knowledge of Content and Pedagogy						Providing descriptive feedback helps students develop the capacity to move their own learning along and therefore demonstrates teachers, content and pedagogical knowledge
	Demonstrating Knowledge of Students		Teachers intimate knowledge of content and pedagogy is reflected in their communications to students about learning goals	Teachers utilize their content and pedagogical knowledge to ensure that useful in moving students along a learning progression and understandable to students	Teachers use their content and pedagogical knowledge as they move away from right/wrong questions and probe students' assumptions that account for their answers	Effective pairing of students for peer assessment so that both students benefit is reflective of the fact that teachers know their students	When teachers provide descriptive feedback, it demonstrates that teachers are dealing with students as individual which suggests that they are knowledgeable about individual students' needs
	Setting Instructional Outcomes	Teachers' facilitation of collaboration require knowledge of their students' strengths and weaknesses	Teachers must know their students' strengths and weaknesses as they set learning goals	Teachers may differentiate and personalize success criteria based upon their knowledge of students current standing along the learning progression	Teachers' use of probing questions will show that they know their students because different questions will be posed to different students	Peer assessment and feedback is guided by the agreed upon learning goals and so helps the student/student interaction to be more productive	When teachers set learning goals, it guides them with respect to the type of feedback they should provide to students

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Planning & Prep continued	Demonstrating Knowledge of Resources	Teachers involve students when setting outcomes for lesson or lesson segments	Teachers' awareness of the standards and performance indicators support their establishment of student friendly learning goals	Meaningful success criteria are not only clear to students, but they are also demonstrative of the learning goals	The use of probing questions by teachers help students stick to the learning goals that were set and discourage a focus on simply having the right answer		Descriptive feedback sometimes refer students back to resources and demonstrate teachers' knowledge of which resources are available and appropriate
	Designing Coherent Instruction		Teachers who are aware of available resources can plan more appropriate learning goals with the knowledge of what strategies students may rely upon when they are challenged		Probing questions may often be a way to direct students to available resources that they can utilize		Since descriptive feedback goes beyond right and wrong, teacher must have developed a coherent instructional plan that will guide the type of feedback provided
	Designing Student Assessment		Teachers' establishment of effective learning goals reflect a purposeful plan and connection between instructional aims, actual instruction, and planned assessments	Meaningful success criteria are a product of teachers' use of coherent instructional plans	As teachers use probing questions it helps them adjust their instructional strategies to fit the changing needs of their students as they attempt to achieve their learning goals		If teachers have already designed appropriate student assessments, this helps guide teachers in terms of the nature of feedback provided to students

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Planning & Prep continued		Teachers share plans for assessments with students prior to instruction	The learning goals set by teachers rely upon his or her plans for student assessments	Teachers are designing effective student assessments when they describe success criteria to students	When teachers use probing questions it helps them to identify misconceptions and incorporate the kind of assessments that tell whether a student has truly grown in their learning		
Classroom Environment	Creating an Environment of Respect and Rapport					When peer feedback is productive it reflects the existence of a respectful rapport among students	Since descriptive feedback focuses on the processes of students' work and not on personalities or extraneous content issues, it promotes respectful rapport
	Establishing a Culture of Learning	Teachers model respect and rapport as they set up their collaborative classroom climate	Teachers/student discussions about learning goals demonstrate respect and engage students in scholarly rapport	Discussing and explaining success criteria is the kind of scholarly discussion that promotes respect and good academic rapport	Probing questions are academic in nature and provide the context for respectful rapport	Productive peer feedback and self assessment are specific behaviors that demonstrate that students are part of a learning classroom culture	By going beyond simply what is right and wrong and focusing on the process of students work, descriptive feedback helps to establish a culture of learning

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Classroom Environment	Managing Classroom Procedures	Teachers encourage collaboration as a means to further learning for all students	The establishment of learning goals sets the tone for a focus on academic objectives	Meaningful success criteria help teachers establish a culture of learning because it encourages and helps students assess themselves with respect to learning goals	Probing questions get at what students understand not simply what they know so that there can be a focus on growth and learning as well as achievement	Teachers are called upon to establish and manage classroom procedures to teach students how to provide productive feedback and self assess	Teachers may collect a great deal of formative data and providing descriptive feedback is a classroom procedure that makes use of that data
	Managing Student Behavior	Teachers must actively model what it means to be collaborative and show respect for others' opinions and eagerness to work together	Teachers can describe classroom procedures in the context of the learning goals that have been set		The use of probing questions demonstrates that teachers established and are managing classroom procedures	When teachers have taught students to self assess and provide productive feedback it helps with managing student behavior because students can stay on task even when the teacher is dealing with a small group or individual	Teachers may encourage students to be more persistent and attentive to detail when they provide descriptive feedback
	Organizing Physical Space	Teachers must actively engage and instruct students as they attempt to become part of the classroom learning community	Learning goals provide a means for teachers to demonstrate how inappropriate behavior distracts from the achievement of agreed upon objectives	When teachers and students are aware of established success criteria, behavior can be evaluated and discussed in terms of how it impacts achievement	Probing questions are a way that teachers can encourage students to persevere without simply giving answers or leaving students to resolve difficulties on their own	Teachers must optimize space to facilitate the collaboration among students that results from soliciting and providing productive feedback	

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Classroom Environment continued		Purposeful seating arrangement may be one way to facilitate the creation of a collaborative climate					
Professional Responsibility	Reflecting on Teaching						
	Maintaining Accurate Records	The creation of a collaborative climate requires that teachers reflect on how they relate to students and whether or not roles are static or shifting	When learning goals are modified, it is usually the result of teachers reflection on past lessons	Meaningful success criteria that students understand demonstrate that teachers have reflected upon their students' needs and their own instructional strategies	Students' responses to teachers' probing questions provide material upon which teachers may reflect		
	Communicating with Families		Learning goals that move along a progression for individual student growth reflect teachers' effective record keeping	Success criteria facilitate the creation and maintenance of useful student		Effective self assessment and productive peer feedback helps build students' capacity to be more productive participants in family discussions about academic matters	Descriptive feedback is another source of information that may enrich communication with families
	Participating in a Professional Community	When students perceive that they are part of a collaborative climate, communication with families can take on a less confrontational nature	The establishment of learning goals and students' progress with respect to those goals provide specific points for discussion with families	When teachers establish success criteria it provides a framework for discussions with families	Students' responses to probing questions gives teachers a better understanding of their students' needs that will enrich communication with families	The provision of productive peer feedback and the encouragement of self assessment mimics the professional community hat teachers model	

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Professional Responsibility continued	Growing and Developing Professionally	Teachers' professional learning community is mirrored in the collaborative classroom	Establishing students learning goals provides a basis for discussions with peers about students' progress	As teachers collaborate, providing students with success criteria facilitates discussions among teachers about how best to align their efforts			
	Showing Professionalism		Teachers grow professionally when they can measure the incremental impact of their instruction in terms of students' achievement of learning goals		The reflection that is aided by students' responses to probing questions help teachers to grow professionally		
		Teachers' demonstration of professionalism is an important model for the collaborative classroom		Students' performance against success criteria facilitates teachers' reflection upon the effectiveness of their practice	Teachers' use of probing questions demonstrate their superior content knowledge and awareness of pedagogical moves		
	Communicating With Students					Self assessment helps students to have more productive communication with teachers	Descriptive feedback forms the basis for productive and scholarly, learning-focused communication with students
Instruction	Using Questioning and Discussion Techniques	Teachers and students must communicate clearly and frequently in the collaborative classroom	Establishing student friendly learning goals require teachers to go beyond posting objectives but to actually engage students so that they understand what they are preparing to do and why	Providing meaningful success criteria requires that teachers and students dialogue about learning goals, strategies, and resources	Communication with students is effective because probing questions provide a critical guide to students and essential data to teachers	Teachers can see the impact of the discussion strategies they modeled, when students provide peer feedback	When teachers provide descriptive feedback, they are employing a discussion technique that encourages student meta cognition

Domain		Setting a Collaborative Climate	Establishing Student-Friendly Learning Goals	Providing Meaningful Success Criteria	Using Probing Questioning Techniques	Encouraging Peer & Self Assessment	Providing Descriptive Feedback
Instruction continued	Engaging Students in Instruction	Teachers must guide students in the use of effective questioning and discussion strategies for the collaborative classroom to work	The establishment of student friendly learning goals is an opportune time for teachers to model and develop discussion techniques	Teachers can model discussion techniques as they communicate with students about expectations	When teachers use probing questions it demonstrates their skill in getting at the source of students' barriers to learning	Evidence of peer feedback & self assessment, shows teachers' facilitation & students' participation	When teachers provide descriptive feedback, it prompts meta cognition and makes students participants in their own learning
	Using Assessment in Instruction	Teachers facilitation of a collaborative classroom helps to engage students by emphasizing the roles students must play in the lesson	Establishing student friendly learning goals help include students in the conversation about what is about to happen in a lesson	Providing meaningful success criteria requires that teachers engage students in discussions about where they are in their learning, where they are going, and how they intend to get there	Teachers' use of probing questions promote meta-cognition in their students	When students are self assessing, it allows teachers to incorporate a powerful form of assessment into instruction, meta cognition	One way to utilize assessment in instruction is to provide descriptive feedback to students so that they can make adjustments and move towards their learning goals
	Demonstrating Flexibility and Responsiveness	Teacher provided information about assessment plans are part of the discussions and scaffolding that drives the collaborative classroom	Establishing student friendly learning goals not only guide teachers in the use of assessments but they also help ensure that students understand the nature of planned assessments and are able to connect classroom activities with expected outcomes	Teachers' discussions with students about success criteria connects instruction and assessment and allows formative assessment strategies to come into play as students move towards their learning goals	The use of probing questions is a form of formative assessment data gathering that directly informs subsequent instructional adjustments and signals to students that they may need to adjust their strategies as well	Teachers demonstrate flexibility when students provide productive peer feedback and self assess because those behaviors shift some responsibility onto students	The provision of descriptive feedback to individual students requires teachers to be flexible in their approach, so that they can meet the needs of students who may be at different points in the learning progression
		Teachers must be flexible because the collaborative classroom involves more active players than the traditional classroom	Student friendly learning goals involve students in a discussion about what is to be learned and help alert teachers to changes to planned instruction and assessment that may be necessary	Since students are drawn into discussions about success criteria, teachers will be called upon to respond to students advocating for themselves	The use of probing questions provides the rationale that teachers can rely upon to be flexible and responsiveness to their students' needs		

Appendix G: Permission to Use Coding Scheme

Hello,

My name is Gregory Sucre. I am a doctoral student at Walden University. My research is focused on high school students' learning through asynchronous discussions when these discussions are designed and facilitated according to the attributes of the assessment for learning process. The process, as outlined by Paul Black and Dylan Wiliam and the Formative Assessment for Students and Teachers SCASS (CCSSO), spells out specific strategies to create and foster a student-driven learning experience.

My study calls for the analysis of discussant's transcripts to ascertain levels of cognitive presence. The coding scheme used in the work by Shea, Hayes, Vickers, Gozza-Cohen, Uzuner, Mehta, Valchova, and Rangan (2010) entitled A Re-examination of the Community of Inquiry Framework: Social Network and Content Analysis fits my research needs. As such, I write to secure your permission to use that coding scheme in my content analysis of discussants' transcripts. I have incorpoated the work of you and your colleagues into my Literature Review and will give full credit to the authors for my use of the coding scheme.

Thank you.

Hi Gregory

Yes – you have my permission for this.

All the best with your research and when it comes time for publication think about our journal as a venue…

Best

Peter

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