Measuring Student Cognitive Engagement When Using Technology

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CHAPTER 1:

RESEARCH PROBLEM AND SETTING

Statement of the Problem

A survey conducted in 2013 by The Harris Poll, revealed 92% of teachers believe technology should be used in the classroom but only 14% are actually integrating technology in their curriculum (Culala, 2016). In a report issued by the U.S. Department of Education (U.S. DOE) (2016) the DOE stated, "School districts have an obligation to provide equitable access to technology in order to close the digital divide and reduce barriers for students while also preparing them for the digital complexities of the future" (p. 22). In addition to access, the U.S. DOE issued the Common Core State Standards (CCSS), a document that stated states are to be held accountable and include over 100 references to technology expectations in today's learning environments. Demographers and social scientists studying populations and the human society have coined the most recent generation of children entering preschool and kindergarten as Generation Alpha (Culala, 2016). These children are following Generation Z and while Generation Z make up about 30% of the global population, Generation Alpha children making their entrance into the world in 2010, are increasing nearly 2.5 million every week (Culala, 2016 & McCrindle 2018). As the most technologically literate group of children enter the classroom, it is necessary to look at current educational practices and consider "the skills, competencies, values needed on the future global age, and how generation alpha should be prepared, scholastically" (Culala, 2016). Speaker, author, and educator, Marc Prensky (2001a) stated, "Today's students are no longer the people our educational system was designed to teach" (p. 1). In an effort to provide access to technology and prepare students for the "digital complexities of the future", school board members in a small, rural community in Southern Iowa recently spent $225,000 to purchase Chromebook and iPads. In addition, administration sent the researcher and a team of teachers to a workshop to be trained in the Instructional Practices Inventory – Technology (IPI-T) process.

The IPI-T process was piloted during the 2017-18 school year after purchasing $100,000 in Chromebooks.

The educational landscape is changing. The learning needs of our Digital Native (Prensky, 2001b) students warrant the integration of technology, however, when teachers do use technology for instruction, they may not be using it to its fullest potential to promote high levels of student cognitive engagement (Alan & Sunbul, 2015; Bixler, 2019; Cuban, Kirkpatrick, & Peck, 2001; Lai, 2016; Lynch et al., 2017; Prensky, 2015; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Samsudin, Guan, Yusof, & Yaacob, 2017; Schrum & Levin 2012; Uhomoibhi & Ross, 2018; Young, Ortiz, & Young, 2017; Zhao, Pugh, Sheldon, & Byers, 2002). It is important to provide in-service teachers the opportunities to learn how to integrate technology into their teaching practices (Beschorner & Kruse, 2016; Boyle & Farreras 2015; Celebi, 2019; Cuban et al., 2001; Dittmar & Eilks, 2019; Kuehnert, Cason, Young, & Pratt, 2019; Serhan, 2019; Russell et al., 2003; Zhao et al., 2002). In line with recent studies (Cuban et al., 2001; Ghavifekr & Rosdy, 2015; Russell et al., 2003) despite large expenditures of Chromebooks, baseline data collected at the targeted high school indicates teachers are the users of technology, rather than students. In addition, 70.4% of the time when technology was being used within the learning activity, students were participating in lower-order, surface thinking.

The Topic

The target school board and administration in this proposed study was interested in determining if students were using the devices as well as if they were cognitively engaged when using technology. Data collected using the IPI-T process suggested teachers were typically the users of the technology, students were often disengaged, and teachers were asking students to participate in lower-order, surface activities. The researcher noticed that the IPI-T data collecting process was not implemented with fidelity. Missing from the process was the implementation of the faculty collaborative sessions.

The Research Problem

The researcher and team of teachers at the target school were trained in the IPI-T data collection process; however, the process was not completed with fidelity because only data collection occurred and faculty did not participate in collaborative sessions. A key piece of the process is the implementation of faculty collaborative sessions to follow each of the four data collecting dates. It is recognized that teachers living in rural, high poverty areas don't always have the same access to digital resources, technology, and professional development opportunities to gain the knowledge and skills to integrate technology in a way that encourages student cognitive engagement as larger, neighboring districts (Howley, Wood, & Hough, 2011; Mangue & Gonondo, 2019; Sundeen & Sundeen, 2013). In order to create change in technology use and increase higher-order, deeper thinking, implementation of the IPI-T process in its entirety was necessary (Valentine, 2012b; Valentine, n. d.). That is teacher leaders collecting the data should engage faculty in studying the data to identify patterns, trends, and changes in each data profile as well as establish and deliver purposeful professional development and continuous conversations (Valentine, 2012b; Valentine, n. d.).

Background and Justification

Research for this study was conducted in a public high school (grades 9-12) located in a small, rural district in Southeast Iowa. The researcher has offered graduate courses, as well as short-term and infrequent mini sessions, to support faculty and the integration of technology. Attendance was on a volunteer basis resulting in zero faculty members participating in the mini sessions and six faculty members out of twenty-seven took advantage of the graduate course work that focused on the integration of technology in ways that increase higher-order, deeper thinking among students. At the start of the 2017-18 school year there were approximately 120 technology devices that included, one cart of 30 Lenovo ThinkPad Laptops in the science wing and a cart of 30 Lenovo ThinkPad Laptops in the English/Language Arts wing, as well as, four computer labs, which housed a total of 60 desktops. In November 2017, the school board approved $100,000 for the purchase of 320 Chromebooks and 10 computer carts. At the beginning of the second semester, 270 new Chromebooks were rolled out among 9 carts. Each core subject area now had access to 60 new Chromebooks and the non-core subject areas still having access to the 60 Desktops plus 30 new Chromebooks as well as the "old" Lenovo ThinkPad Laptops. To date the building has a nearly 2:1computer to student ratio and an additional $125,000 was spent in 2018 to increase Chromebooks and iPads across the district. The IPI-T data collection team coded 217 observations from January 2018 through April 2018 after increasing technology devices nearly one per student at the high school. Analysis of the data showed only 95 observations were coded in which students were the users of technology. Based on this data, the researcher wondered why faculty was not taking advantage of the newly purchased devices and integrating technology into classroom instruction. She wondered if implementing the IPI-T process in its entirety would make a difference in technology use among teachers and students and if teachers would change their practice and offer learning activities that promoted higher-order, deeper thinking. Jerry Valentine, Professor at the University of Missouri, and graduate assistant Bryan Painter, created the Instructional Practices Inventory (IPI) in 1996. The IPI measures student cognitive engagement. In 2001, Valentine began to recognize the need to add a technology component to the measuring tool as schools were moving 1:1 with technology devices, resulting in the creation of the Instructional Practices Inventory – Technology (IPI-T). As defined within Valentine's Instructional Practices Inventory - Technology (IPI-T), each category coded describes the level of student engagement and are referred to as:

6. Student Active Engaged Learning
5. Student Verbal Learning Conversations
4. Teacher-led Instruction
3. Student Work with Teacher Engaged
2. Student Work with Teacher Not Engaged
1. Student Disengagement

It is important to note that the categories are not a hierarchy but rather "six distinct ways to categorize student engagement" (Valentine, 2017, p. 2). According to Valentine (2012c), Categories 5 and 6 are coded when students are observed participating in higher-order, deeper thinking activities such as decision making from analysis, collaboration among peers, and creative and innovative thinking. Categories 2, 3, and 4 include lower-order, surface activities such as basic fact finding, recall and memorization, and simple understanding (Workshop handouts, p. 2). The researcher of this study is a member of the Instructional Practices Inventory-Technology data collection team in rural, Southern Iowa school district. The first set of codes was collected within the high school as a pilot of the measurement tool January 2018, shortly after the purchase of Chromebooks. After 217 observations of 27 high school classrooms, 95 observations were coded as students using technology and 59 observations were coded as teachers using technology. When observed using technology, students were engaged in lower-order, surface thinking activities 70.4% of the time. Coding took place four times during the school year 2017-18. The researcher noticed technology use by the teacher decreased slightly, increasing student use of technology, but disengagement increased dramatically as did the integration of activities that fall within Categories 4, 3, and 2 on the IPI-T. This is not surprising as the researcher and the IPI-T data collection team did not implement the IPI-T process with fidelity. Valentine (2012b) stated, "The greater the implementation integrity to these strategies, the greater the likelihood the school will see positive academic results from their use of the IPI" (p. 1). Missing from the process during the 2017-18 pilot of the IPI-T was the implementation of faculty collaboration sessions. The sessions provide faculty with time to study the data after each data collection, engage faculty in reflecting about the data, create collaborative learning experiences to build new knowledge, and allows faculty voice in establishing annual cognitive engagement goals.

Deficiencies in the Evidence

Barriers that prevent the integration of technology by classroom teachers have identified and thoroughly documented in the existing literature, (Ertmer, 1999; Hew & Brush, 2007; Kopcha, 2012). According to the Barrier to Technology Model, external and internal barriers influence the integration of technology in teacher's classrooms (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). First-order barriers are known as resource barriers (e.g., access to technology devices, availability of technical support, and sufficient time allowance to prepare for technology-integrated instruction) and institutional barriers (e.g., administrator's priority and school-wide plan for technology integration) (Hew & Brush, 2007; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018). Recognized as the "most proximal determinant of technology integration" (Vongkulluksn, et al., 2018) is among the second-order barriers, teachers' value beliefs regarding the importance of technology for learning (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer et al., 2012). According to Vongkulluksn et al. (2018), "Teachers' value beliefs about technology refer to the extent to which teachers believe that technology can help fulfill instructional goals they identified as most important for their students" (p. 71). Organizations such as the U.S. Department of Education, International Society for Technology Education (ISTE), and the Partnership for 21st Century Learning (P21) provide regulations, standards, or a framework that simply states that there is a need for ongoing professional development for faculty. Vongkulluksn, et al. (2018), suggested that "teachers' value beliefs towards technology to be highly predictive of the quantity and quality of technology integration" (p. 71). It is important to use technologies to enhance learning experiences in different school settings and environments (Davis, Preston, & Sahin, 2009; Karahan & Roehrig, 2016; Perdana, Jumadi, & Rosana, 2019; Sahin, 2007). There are few studies, if any, available that suggests a particular strategy or plan that indeed targets teachers' value beliefs and provides teachers with the skills necessary to increase student cognitive engagement when technology is integrated into their learning environment.

Audience

Initially faculty within the target school district will benefit from this study. It is hypothesized faculty will see an increase in student cognitive engagement. as well as higher-order deeper thinking with a reduction in disengagement, positively influencing student academic achievement. In addition, students will demonstrate having the necessary skills for success in the twenty-first century. The goal is to present research-based data for school board members to have a better understanding of technology use and how the recent expenditure of technology has impacted classroom practices and student engagement.

Setting of the Study

This study takes place in a rural, high-poverty school district in Southern Iowa. Total student population in the district is 1,426. The district is home to five school buildings: a preschool, one building for all students in grades kindergarten through first, one building for all students in second through fifth grade, a junior high made up of grades six through eight, and the high school where students in grades nine through twelve attend. Students and faculty from the high school, grades 9-12 are the focus of this research. Enrollment at the target high school is just over 400 students in grades 9-12 and close to 30 certified faculty members. A typical school day begins at 8:10 a.m. and ends at 3:20 p.m. and is made up of eight periods in a day. Core courses include a variety of offerings in the following subjects: Math, Science, Social Studies, and English Language Arts (ELA). The majority of the non-core courses is part of the Career Technical Education (CTE) program and includes metals, welding, art, agriculture courses, and business education.

Researcher's Role

The researcher is an employee of Iowa Public Television (IPTV) with the title of Teacher Ambassador (TA). The role of the TA is to support educators through community building and professional development opportunities. As a former classroom teacher, my position as a TA was brought onto the IPTV staff with the goal to improve learning outcomes for all children – especially those who need the most help. In order to help students, it's critical that we support educators, who play a critical role in their learning. To best serve educators the Teacher Ambassador was embedded full-time in targeted school district. Teachers in this rural community report feeling isolated and have limited access to digital resources, technology, and professional development opportunities to gain the knowledge and skills to integrate technology in a way that encourages student use of technology and increases student cognitive engagement.

Purpose of the Study

The purpose of this explanatory-sequential mixed method study was to assess the impact of the IPI-T process on technology use and student cognitive engagement. The goal was to implement all strategies, including faculty collaborative sessions four times per year to support teacher implementation of new technology to increase higher-order, deeper thinking by students and increase student use of technology. The impact was measured by comparing quantitative IPI-T data codes of those faculty that participated in the intervention group with baseline data prior to the implementation of the faculty collaborative study sessions. Data collected during the quantitative phase was the emphasis of this study. Qualitative data was gathered from one participant from each core and non-core area, a total of eight participants. Each were asked to answer questions on a web-based questionnaire during the final faculty collaborative session. After identifying themes, the qualitative data was analyzed for themes and then because the data was collected in sequence, findings were associated with the quantitative results of the IPI-T to determine how and why the data converged. In addition, the researcher used the qualitative data to explore key results found when collecting quantitative data that lead to the acceptance or rejection of the null hypothesis.

Definition of Terms

Educational Technology

Educational technology is defined as, “The study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Januszewski & Molenda, 2013, p. 1). This research study focused on the types of technology often used in today’s educational or classroom setting such as interactive whiteboards, iPads, Chromebooks, cellular devices, digital cameras, and the Internet to name a few.

Generation Z

Generation Z, also referred to as digital natives, include persons born after 1995 and are known as the first generation to be born into a “globally (Internet) connected world and therefore ‘live and breathe’ technology” (Cilliers, 2017; Grail Research, 2011; Rothman, 2016). Students observed within the targeted high school are considered to be a part of Generation Z.

Generation Alpha

Generation Alpha are children born after 2010, entering preschools and kindergarten. These children are following Generation Z and make up about 30% of the global population, increasing nearly 2.5 million every week. Furthermore, children belonging to Generation Alpha are considered the most technologically literate group to enter the classroom yet (Culala, 2016 & McCrindle 2018). It is imperative teachers gain the skills necessary to meet the needs of our children entering classrooms today.

Student Cognitive Engagement

According to Fred Newmann, (as cited by Voke, 2002) author of the 1992 book *Student Engagement and Achievement in American Secondary Schools*, engaged students make a “psychological investment in learning. They try hard to learn what school offers. They take pride not simply in earning the formal indicators of success (grades), but in understanding the material and incorporating or internalizing it in their lives" (pp. 2–3). The IPI-T process measures student cognitive engagement when using technology and is the focus of the data presented to faculty during the collaborative sessions (Valentine, 2012c, p. 2).

Higher-order Thinking

Higher-order thinking activities are said to "challenge the student to interpret, analyze, or manipulate information" (Lewis & Smith, 1993).

Lower-order Thinking

Lower-order thinking activities "demand only routine or mechanical application of previously acquired information such as listing information previously memorized and inserting numbers into previously learned formulas" (Lewis & Smith, 1993). A balance of higher-order/deeper thinking and lower-order surface thinking is necessary to promote an increase in student achievement (Valentine, 2012c, p. 2).

Instructional Practices Inventory Categories

Instructional Practices Inventory Categories are represented numerically (see Appendix A). Each category describes the level of student engagement and are referred to as:

6. Student Active Engaged Learning
5. Student Verbal Learning Conversations
4. Teacher-led Instruction
3. Student Work with Teacher Engaged
2. Student Work with Teacher Not Engaged
1. Student Disengagement

The IPI and the IPI-T both utilize each of the six categories. It is important to note that the categories are not considered a hierarchy but rather "six distinct ways to categorize student engagement" (Valentine, 2017). Categories 6 and 5 include learning activities that fall within the higher-order, deeper thinking spectrum of Bloom's Taxonomy and Bloom's Digital Taxonomy such as analysis and creating while Categories 4, 3, and 2 include lower-order, surface thinking activities such as recalling simple facts and googling for answers.

Categories of Technology Use

Categories of technology use include the following eight categories: (a) Word Processing; (b) Math Computations; (c) Media Development; (d) Information Search; (e) Collaboration Among Individuals; (f) Experience-Based Immersion Learning; (g) Interactive/Presentation Technology; (h) Other (Valentine, 2012c). These eight categories are used to document or code how technology is being used for learning and is similar to the coding process for collecting IPI data. However, during the IPI-T process, the individual collecting the data "documents the total number of students and the numbers using and not using technology and makes two IPI engagement codes, one for all students and one for 'only the tech students'" (Valentine, 2015).

Summary

Chapter one included a statement of the problem along with a description of the setting in which this study took place. The purpose of this embedded quasi-experimental mixed method study was to assess the impact of the IPI-T process on technology use and student cognitive engagement. The goal was to implement all strategies, including faculty collaborative sessions four times per year to support teacher implementation of new technology to increase higher-order, deeper thinking by students and increase student use of technology.

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CHAPTER 2:

LITERATURE REVIEW

A thorough review of the literature is included in chapter two, beginning with a look at the current realities for many districts after purchasing technology and then trying to align current teaching practices with the integration of technology. Such alignment efforts must consider the characteristics of current students as digital natives, Generation Alpha and Generation Z, as well as the characteristics of digital immigrants and the connection to current classroom practices when integrating technology. Student cognitive engagement and the integration of technology is at the heart of this study, specifically higher-order thinking and lower-order thinking skills and activities outlined in Bloom's Original Taxonomy and the revised Bloom's Digital Taxonomy. Chapter 2 continues with a detailed look at the IPI and IPI-T data collection protocol to measure student cognitive engagement and technology use, including how the implementation of the Faculty Collaborative Sessions have been used to breakdown the barrier to technology use and increase student cognitive engagement and higher-order thinking. In addition, a historical look at the IPI and IPI-T process, a review of the research conducted using the data collecting process, and the reliability of the IPI and IPI-T as a tool for collecting data to measure student cognitive engagement is included within the literature review.

Many schools and districts have spent a significant amount of money in an effort to become 1:1 with their devices or at the very least considered high-tech schools (Cuban et al., 2001; Russell et al., 2003; Zhao et al., 2002). McClure, Jukes, and MacLean (2011) maintained, rather than racing to purchase 'stuff', there is a need to shift teacher practice, and collaboratively work to change pedagogy, teaching, learning, and assessment to impact student success. Ultimately district leaders and faculty find themselves in a position of wondering how they might utilize the newly purchased devices to increase student cognitive engagement as well as achievement in an effort to justify their recent technology expenditures (Cuban et al., 2001; Russell et al., 2003; Zhao et al., 2002). Adding to this challenge, teachers living in rural, high poverty areas don't have the same access to digital resources, technology, and professional development opportunities to gain the knowledge and skills to integrate technology in a way that encourages student cognitive engagement as larger, neighboring districts (Howley, Wood, & Hough, 2001). McClure et al. (2011) argued that faculty must participate in an ongoing, multistep method to align the implementation of technology with their learning goals. In addition, McClure et al. (2011) explained the first step of alignment involves gathering data to determine the exact practices of teachers regarding technology use. The data should then guide the creation of action plans to set the goal of technology alignment. Once a plan is in place it is important to participate in ongoing assessment of the plan to determine the effectiveness.

The Instructional Practice Inventory – Technology (IPI-T) was created by Dr. Jerry Valentine in an effort to address the growing use of technology in the classroom. The IPI-T can be used to help faculty in the alignment process. It is a walkthrough observation process designed to collect data concerning how often and in what ways teachers are integrating technology as well as how often students are cognitively engaged in higher-order, deeper (HO/D) thinking as well as lower-order surface (LO/S) thinking. The implementation of the IPI-T process includes engaging faculty in collaborative sessions within one week after each data collection. Faculty collaborative sessions allow all faculty to reflect about the data and establish cognitive engagement goals. Implementing the entire IPI-T with fidelity increases the likelihood that the targeted schools will see a positive influence on student achievement as they move toward a 1:1 environment. Valentine (2013) stated, "Cognitive psychologists studying engagement for many years noted that as students get older and progress through the K-12 learning experience, the pattern of focus during learning time declines" (p. 1). Furthermore, Valentine (2013) reported that students are typically engaged in HO/D thinking activities only 60-70 minutes per day. "Increasing the HO/D time by 15 minutes means an HO/D increase of about 20-25%...translates into an increase of 2-3% high stakes pass rates over two years; an increase of 8-10 full school days of more HO/D thinking per year and a conservative estimate of 100-125 school days of more HO/D thinking during a thirteen year schooling experience (Valentine, 2013, p. 1). Valentine (2012c) has collected tens of thousands of codes, educating more than 23,000 educators in the IPI-T data collection process. Valentine (2012c) explained, "Findings from our quantitative studies of the relationships between IPI-T cognitive engagement data and achievement parallel findings from other studies of the past two to three decades, i.e. increasing engagement and higher-order deeper thinking during learning time and conversely reducing disengagement during learning time positively influence student academic success” (p. 1).

Students’ Technology Experiences

Today technology is woven into our student’s lives. According to Prensky (2001), students today are, “native speakers of the digital language of computers, video games, and the Internet” (p. 1). Prensky called these native speakers Digital Natives. Demographers and social scientists studying populations and the human society have coined the most recent generation of children entering preschool and kindergarten as Generation Alpha (Culala, 2016). These children are following Generation Z and while Generation Z make up about 30% of the global population, Generation Alpha children making their entrance into the world in 2010, are increasing nearly 2.5 million every week (Culala, 2016 & McCrindle 2018; Yahya & Adebola, 2019). Others prefer to not assign labels to learners today as they state, “these terms and their meanings do not accurately represent every individual that might fall into such categories” (Milman, 2009, p. 59). Empirical evidence has shown the use of digital technology is growing and there is a need to focus on digital learners, not digital natives (Autry & Berge, 2011; Bullen, Morgan, Qayyum & Qayyum 2011; Milman, 2009; Sahin & Shelley, 2008; Walters, Gee, & Mohammed, 2019).

Digital tools available today for learning, teaching, and communicating are different (Milman, 2009). The Harris Poll conducted a survey in 2013 and found 92% of the teachers polled said “they think EdTech tools should be used in the classrooms but only 14% of them are actually integrating technologies into their curriculum” (as cited by Culala, 2016). Alphas are predicted to be highly immersed with technologies (Culala, 2016; McCrindle, 2018). According to Culala (2016) students are not simple users but “they are born with a ‘tech thumb’”. Living in a highly mobile and technologically advanced society today’s students prefer to communicate using social media, they were born into a world where Internet has always been available, and are the first fully global generation, who prefer Google and YouTube over lectures and PowerPoint presentations (Billings, Kowalski, & Shatto, 2016; Culala, 2016; Rothman, 2014; Shatto &Erwin, 2017). Prensky (2001a), maintained that students today think and process information differently than others before them. Supported by social psychologists is the theory of neuroplasticity; this theory is based on the premise that individuals thought process pattern changes with their experiences (Autry & Berge, 2011). As cited by Prensky (2001b), Dr. Bruce D. Perry of Baylor College of Medicine has found “different kinds of experiences lead to different brain structures” (p. 1). Technology’s influence on brain development of today’s students implies the need to make thoughtful and informed decisions about the engagement of learners and changing instruction to meet the needs of today’s learners (Autry & Berge, 2011; Milman, 2009; Namyssova, Tussupbekova, Helmer, Malone, Afzal, & Jonbekova. 2019; Prensky, 2001, Tapscott, 2009). As the most technologically literate group of children enter the classroom, it is necessary to look at current educational practices and consider “the skills, competencies, values needed on the future global age, and how generation alpha should be prepared, scholastically” (Culala, 2016). However, changing current educational practices regarding the use and integration of technology can be complex and messy (Zhao, Pugh, Sheldon, & Byers, 2002).

Teachers’ Technology Experiences

Barriers that prevent the integration of technology by classroom teachers are identified and thoroughly documented in the existing literature (Ertmer, 1999; Hew & Brush, 2007; Kopcha, 2012). The Barrier to Technology model, suggests there are two sets of barriers, external and internal, that influence the integration of technology in teachers’ classrooms (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). First order-external barriers are also known as resource barriers. Sufficient time allowance to prepare for technology-integrated instruction is an example of a resource barrier (Hew & Brush, 2007; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018). In addition, Vongkulluksnet al. (2018) considered the second order-internal barriers, teachers’ value beliefs as the “most proximal determinant of technology integration” regarding them most important to using technology for learning (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer et al., 2012). Over the past 30 years, hundreds of studies have been conducted to determine how a particular type of technology impacts student learning, which technological innovation is “more of less effective than traditional instruction”, however, little research has been conducted to determine how and why American teachers use technology (Zhao et al., 2002, p. 483). Access to technology in most cases is no longer the major issue (Schrum & Levin, 2015; Zhao et al., 2002); however, computer usage in the classroom among students remains low (Cuban, 1999; Wang, Hsu, Campbell, Coster, Longhurst, 2014; Zhao et al., 2002). Removing barriers to technology use such as sufficient time allowance to prepare for technology-integrated instruction (Hew & Brush, 2007; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018) and increasing teacher's ability beliefs increases the likelihood teachers will use technology to fulfill instructional goals that are student-centered and lead to student achievement (Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018).

Personal Pedagogical Beliefs

According to Denessen (2000), pedagogical beliefs refer to the understandings about teaching and learning that teachers hold to be true (as cited in Tondeur et al., 2016). Described by Pajares (1992), a teacher's belief system includes beliefs about their roles and responsibilities, the subject matter taught, as well as beliefs about their students (as cited in Tondeur et al., 2016). Complex and multifaceted pedagogical beliefs include core beliefs, those that are most stable and the most difficult to change as they have connections to other beliefs versus beliefs that are peripheral and formed recently are more open to change (Tondeur et al., 2016). Although evidence does indicate that the integration of technology in the learning process is steadily increasing, "achieving technology integration is still a complex process of educational change" (Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2016). Deng, Chai, Tsai, and Lee, (2014) along with Inan and Lowther, (2010) maintained that personal pedagogical beliefs of teachers "play a key role in their pedagogical decisions" to integrate technology within their classroom practices (as cited in Tondeur et al., 2016). Within the field of education technology teachers' beliefs have been classified into one of two categories: teacher-centered and student centered beliefs. Teacher-centered beliefs, associated with behaviorism, tend to emphasize subject matter and discipline while the teacher acts as the authority and serves as the expert in a highly structured learning environment that is typically associated with activities that a teacher uses to promote learning (Deng et al, 2014; Kim, Kim, Lee, Spector, & DeMeester, 2013; Tondeur et al., 2016). In contrast, Kerlinger and Kaya (1959) and Mayer (2003) maintained student-centered beliefs are typically associated with constructivism, emphasizing individual student needs and interests and revolving around students engaged in and actively participating in authentic and relevant learning opportunities (Ertmer and Glazewski, 2015; Kim et al., 2013; as cited in

Tondeur et al., 2016). Educational technology best practices are those that promote student-centered learning (Ottenbriet-Leftwich, Glazewski, Newby, and Ertmer, 2010; Tondeur et al, 2016). Jonassen (1996) noted meaningful use of technology occurs when students use a computer as a mindtool to achieve higher levels of thinking and reduce cognitive load (as cited in Ottenbriet-Leftwich et al., 2013). Student-centered learning is said to increase academic performance and help students develop lifelong skills such as problem solving and self-regulation (Ottenbriet-Leftwich et al., 2013; Tondeur et al., 2016).

Collaborative Learning

Removing barriers to technology use such as sufficient time allowance to prepare for technology-integrated instruction (Hew & Brush, 2007; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018) and increasing teacher's ability beliefs increases the likelihood teachers will use technology to fulfill instructional goals that are student-centered and lead to student achievement (Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018). The significance of collaborative learning among teachers has been documented in the literature (Faculty Collaborative Study, n.d.; Hattie, 2012). Valentine (n.d.) maintained, that periodic collaborative learning among teachers to set common goals, "to build knowledge and professional skills, and to discuss professional values and beliefs together" is the key ingredient in quality professional development that drives learning and academic success of students (Faculty Collaborative Study). Hattie (2012), pointed out, "teachers' beliefs and commitments are the greatest influence on student achievement over which we can have some control" (p. 25). Engaging faculty in a series of collaborative study sessions of the IPI-T data has been shown to have the capacity to remove barriers to technology use by teachers to fulfill instructional goals, increase teachers' ability beliefs, increase student usage of technology, and positively impact student cognitive engagement and academic success (Jensen, 2016; Valentine 2012a; Valentine, 2013).

Student Cognitive Engagement

Historically student engagement has focused on three areas: increasing achievement, positive behaviors, and a sense of belonging as an effort to retain students (Parsons & Taylor, 2011; Dunleavy, Milton, & Willms, 2012). Recently student engagement has become a strategic process, one in which is built around the goal of "enhancing all students' abilities to learn how to learn or to become lifelong learners in a knowledge-based society (Parsons & Taylor, 2011). Fredricks, Blumenfeld, and Paris (2004) maintained student engagement is a complex process that can be divided into three basic categories—behavioral, emotional and cognitive:

1. Behavioral engagement draws on the idea of participation; it includes involvement in academic and social or extracurricular activities and is considered crucial for achieving positive academic outcomes and preventing dropping out.
2. Emotional engagement encompasses positive and negative reactions to teachers, classmates, academics, and school and is presumed to create ties to an institution and influence willingness to do the work.
3. Cognitive engagement draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills.

For the purpose of this study, the focus will be on the latter, student cognitive engagement. While definitions vary, cognitive engagement is defined by Fredericks, Blumenfeld, and Paris (2004) as "a psychological investment in learning, a desire to go beyond the requirements of school, and a preference for challenge" (p. 7). Adapted from Fredericks et al. (2004), student cognitive engagement is "The expenditure of thoughtful energy needed to comprehend complex ideas in order to go beyond the minimal requirements" (as cited by Finn and Zimmer, 2012, p. 102). According to Finn and Zimmer (2012), "High levels of cognitive engagement facilitate students' learning of complex material" (p. 102-103). Finn and Zimmer found behaviors that are suggestive of cognitive engagement include "asking questions for the clarification of concepts, persisting with difficult tasks, reading more than the material assigned, reviewing material previously, studying sources of information beyond those required, and using self-regulation and other cognitive strategies to guide learning" (p. 102-103).

Measuring Student Engagement

There has been an increased interest in understanding and collecting data on student engagement. Various reasons have been cited and include: a growing awareness of the relationship between student disengagement and failure to complete school, the inclusion of student engagement as a goal of school improvement, and use of student engagement as a program or intervention outcome (Dunleavy, Milton, P, & Willms, 2012; Fredricks, McColskey, Meli, Mordica, Montrosse, & Mooney, 2011). Fredricks et al. (2011), reviewed 21 instruments used to measure dimensions of engagement in a tabular format (see Figure 1). Fourteen of the 21 instruments reviewed were student self-report instruments, three teacher reports on students, and four observational measures. Instruments varied and could have been used for measuring student engagement in upper elementary through high school.

TABLE 2
Dimensions of engagement assessed by instruments

Instrument	Behavioral	Emotional	Cognitive
Student self-reports			
Multidimensional			
4-H Study for Positive Youth Development: School Engagement Scale (4-H)	✓	✓	✓
High School Survey of Student Engagement (HSSSE)	✓	✓	✓
Motivation and Engagement Scale (MES)	✓	✓	✓
School Engagement Measure (SEM)-MacArthur	✓	✓	✓
Student School Engagement Survey (SSES)	✓	✓	✓
Bidimensional			
Attitudes Towards Mathematics Survey (ATM)	✓		✓
Education versus Disaffection with Learning (EvsD), student report	✓	✓	
Research Assessment Package for Schools (RAPS), student report	✓	✓	
School Success Profile (SSP)	✓	✓	
Student Engagement Instrument (SEI)		✓	✓
Unidimensional			
Consortium on Chicago School Research/Academic Engagement Scale (CCSR/AES)	✓		
Identification with School Questionnaire (ISQ)		✓	
Motivated Strategies for Learning Questionnaire (MSLQ)			✓
School Engagement Scale/Questionnaire (SEQ)	✓		
Teacher reports			
Engagement versus Disaffection with Learning (EvsD), teacher report	✓	✓	
Research Assessment Package for Schools (RAPS), teacher report	✓	✓	
Reading Engagement Index (REI)	✓	✓	✓
Observational measures			
Behavioral Observation of Students in Schools (BOSS)	✓		
Classroom AIMS	✓	✓	
Code for Instructional Structure and Student Academic Response (MS-CISSAR)	✓		
Instructional Practices Inventory (IPI)			✓

Source: Authors' analysis of instrument documentation.

Figure 1. Measuring Student Engagement [A visual representation showing the dimensions of engagement (behavioral, emotional, and cognitive) assessed by various instruments. Retrieved from http://ies.ed.gov/ncee/edlabs. Reprinted with permission from Kathleen Mooney.]

Among the 21 instruments reviewed was the IPI. Other observational measures included in the review were the Behavioral Observation of Students in Schools (BOSS), the Classroom AIMS, and the Code for Instructional Structure and Student Academic Response (MS-CISSAR). In comparison, the BOSS, is used with prekindergarten through grade 12 students to measure individual student' on-task and off-task behavior or academic engagement time to record two categories of engagement and three categories of non-engagement. Developed for use by school psychologists, the instrument is used to screen students at risk of academic failure and for school psychologists, researchers, and evaluators to track the effectiveness of interventions over time. Interobserver reliability of the BOSS after training is reported to be 90-100 percent (Fredricks et al., 2011).

The Classroom AIMs is used with elementary school teachers (K-2) to evaluate multiple domains associated with effective teaching practices: atmosphere, instruction/content, management, and student engagement. Engagement is further measured with four items: students on task and highly engaged in class activities; self-regulated behaviors; participating in class; and expressing excitement. Classroom AIMS is typically used with elementary school teachers, however, the instrument was used in one study with secondary teachers (Fredricks et al., 2011). Stanulis and Floden (2009) reported that within the study, the interrater reliability for individual items was 65 percent and it was unclear which statistics corresponded to the student engagement scale or if the engagement items could be used independently of the whole set of AIMS items (as cited by Fredricks et al., 2011).

In 1981, development of the MS-CISSAR helped to gain a better understanding of how student academic responding, interacts with teacher behavior and classroom settings. Used in elementary, middle, and high schools, trained observers collect data on specific students so practitioners can improve instruction and results for students. MS-CISSAR consists of a 105 event taxonomy organized by student behavior, teacher behavior, and ecological setting. Training to use the measurement is provided through drill and practice tutorials. Wallace, Anderson, Bartholomay, and Hupp (2002) reported interobserver reliability as 85-92 percent (as cited in Fredricks et al., 2011). When comparing observational measures to assess student engagement, Fredricks et al., (2011) reported the IPI as the only observational measure used to collect data on student cognitive engagement. The IPI and IPI-T was chosen in the targeted school district to determine if students were using the newly purchased Chromebooks as well as if they were cognitively engaged when using technology. In addition to collecting data, the IPI and IPI-T process is used for faculty reflection, instructional change, and school improvement (as cited in Fredricks et al., 2011; Valentine, 2013; Valentine, 2017).

Rationale for Studying Student Engagement

For many years, cognitive psychologists studying cognitive engagement have noted "that as students get older and progress through the K-12 learning experience, the pattern of focus during learning time declines (as cited by Valentine, 2013, p. 2). Valentine (2013) reported, "In our IPI data, this is evidenced by the lower average percentages of disengagement during elementary school (2-3%) followed by higher percentages in middle schools (3-4%) and the highest percentages in comprehensive high schools (6-8%)" (p. 2). Not surprising when considering today's students are different from generations before them (McCrindle, 2014; Prensky, 2005; Schrum & Levin, 2015; Tapscott, 2009). Technology's influence on brain development of today's students implies the need to make thoughtful and informed decisions about the engagement of learners and changing instruction to meet the needs of today's learners (Autry & Berge, 2011; Milman, 2009; Prensky, 2001a, Tapscott, 2009). Many of today's students, particularly as they progress to high school, appear to be disengaged, unmotivated, and uninterested in learning (Prensky, 2001a; Prensky, 2005; Schrum & Levin, 2015). Shernoff, Csikszentmihalyi, Schneider, and Shernoff (2003) reported over a quarter of the day, secondary students are in a disconnected state, such as boredom (as cited by Jensen, 2016). Hattie (2012) reported that expert teachers with the ability to assist students in the development of deep and conceptual understandings have an effect size of 1.0 (p. 32-33). Hattie (2012) referred to the "hinge-point" for identifying what is and what is not effective as d=0.40 or an effect size of 0.40 (p.3). In a blog post titled, "Principal of Change: Stories of Learning and Leading", Couros (2013) described what today's students need to reach their full potential growing up as 21st century learners (as cited by Schrum & Levin, 2015). Couros admitted, although technology is not the focus, it does give us many opportunities to magnify the opportunities such as supporting student voice and student choice, providing time for reflection and opportunities for innovations, foster critical thinking and problem-based learning that supports problem solving among students, opportunities for self-assessment, and connected learning through collaboration not just locally but globally (as cited by Schrum & Levin, 2015). In an effort to align current teaching practices with the integration of technology and reach today's students, the IPI and IPI-T process assists in the collection of data to get an insight into how students are engaging in the learning during the instructional activity.

Theoretical Perspectives

Empirical evidence shows the use of digital technology is growing, digital tools available today for learning, teaching, and communicating are different (Milman, 2009), and a need to focus on digital learners (Autry & Berge, 2011; Bullen & Morgan, 2011; Milman, 2009). Technology experiences are much different for students today than generations before them. The engagement of faculty in a series of collaborative study sessions of the IPI-T data does not teach faculty how to use educational technology but rather how students are engaging in the learning during the instructional activity. Engagement of faculty in Faculty Collaborative Study Sessions have been shown to have the capacity to remove barriers to technology use by teachers to fulfill instructional goals, increase teachers' ability beliefs, increase student usage of technology, and positively impact student cognitive engagement and academic success. The IPI and IPI-T encourages faculty members to work towards a balance of higher and lower levels of student cognitive engagement through incremental changes in instructional practice (Dennis, 2013). The theoretic underpinnings of the IPI and IPI-T process points to a firm grounding in Bloom's Taxonomy, Bloom's Revised Taxonomy, and the most recent Bloom's Digital Taxonomy.

Bloom's Taxonomy

Benjamin S. Bloom published a handbook in 1956 titled, Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook 1: Cognitive Domain (Anderson & Krathwohl, 2001; Bloom, 1956; Forehand, 2011). Bloom was considered one of the most influential theorists to promote mastery learning and higher level thinking (Forehand, 2011). Bloom created a taxonomy or classification system that organized educational objectives according to their cognitive complexity (Churches, 2008; Forehand, 2011; Anderson & Krathwohl, 2001). Referred to as a framework, the taxonomy of educational objectives is made up of six major categories of the cognitive domain (Anderson & Krathwohl, 2001; Bloom, 1956; Krathwohl, 2002). Forehand (2011) stated, "Bloom's Taxonomy is a multi-tiered model of classifying thinking according to six cognitive levels of complexity" (p. 2). Depicted as a stairway, many teachers have encouraged their students to 'climb to a higher (level of) thought' (Forehand, 2011, p. 2). The lowest three levels are: knowledge, comprehension, and applications. The highest three levels are: analysis, synthesis, and evaluation. The taxonomy is hierarchical; each level leads up to the higher levels. It is this arrangement or hierarchy that has led to the 'natural divisions of lower and higher level thinking' (Forehand, 2011). The original taxonomy or framework created by Bloom was a way to classify (Anderson & Krathwohl, 2001; Bloom, 1956; Forehand, 2011; Krathwohl, 2002) what "we expect or intend students to learn as a result of instruction" (Krathwohl, 2002, p. 212). Bloom saw the original Taxonomy as more than a measurement tool and believed it could serve as a common language about learning goals to facilitate communication across persons, subject matter, and grade levels" (Krathwohl, 2002). According to Krathwohl (2002), Bloom believed the original taxonomy could serve as a:

1. Common language about learning goals to facilitate communication across persons, subject matter, and grade levels.
2. Basis for determining particular course or curriculum the specific meaning of broad educational goals, such as those found in the currently prevalent national, state, and local standards.
3. Means for determining the congruence of educational objectives, activities, and assessment in a unit, course, or curriculum.
4. Panorama of the range of educational possibilities against which the limited breadth and depth of any particular educational course or curriculum could be considered (p. 212).

Bloom's Revised Taxonomy

A former student of Bloom's, Lorin Anderson along with David Krathwohl, led a group in an effort to update the original Bloom's Taxonomy to add relevance for students and teachers in the 21st century (Churches, 2008; Forehand, 2011; Anderson & Krathwohl, 2001). Major changes include the use of verbs rather than nouns for each category as well as the arrangement of the sequence within the taxonomy and the omission of synthesis and addition of creating (Churches, 2008 & Anderson & Krathwohl, 2001).

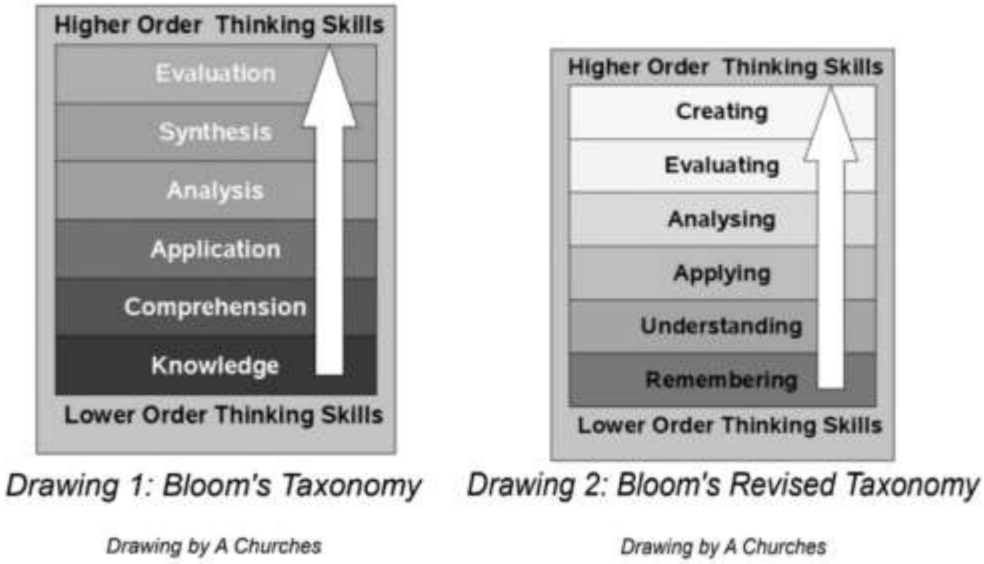

Figure 2. Bloom's Taxonomy and Bloom's Revised Taxonomy [A visual representation showing the revisions made to the original Bloom's Taxonomy resulting in the omission of synthesis and the addition of creating. Retrieved from http://burtonslifelearning.pbworks.com/f/BloomDigitalTaxonomy2001.pdf. Reprinted with permission from Andrew Churches.]

Both versions of Bloom's represent the process of learning. The arrangement of the six categories may lead others to believe one must first remember to understand and apply, and so on, that is not the case (Churches, 2008; Krathwohl, 2002). But rather a hierarchy exists within the six categories and is believed to differ in their complexity (Krathwohl, 2002). For example, the act of understanding is said to be more complex than remembering but less complex than applying (Krathwohl, 2002).

Bloom's Digital Taxonomy

Bloom's original taxonomy published in 1956 was made up of six levels of cognitive thinking, structured as a multi-tiered model, 45 years later revised once again. A more recent revision of the original Bloom's Taxonomy and the revised Taxonomy is known as Bloom's Digital Taxonomy. Created by Andrew Churches in 2008, Churches stated (2008), "The Original taxonomy and the revised taxonomy by Anderson and Krathwohl are both focused within the cognitive domain. The Digital Taxonomy is not restricted to the cognitive domain rather it contains cognitive elements as well as methods and tooling" (p. 2). Bloom's Digital

Taxonomy "is about using technology and digital tools to facilitate learning" and "student engagement is defined with 'power verbs'" (Churches, 2008). The verbs making up the taxonomy include lower-order thinking skills: remembering, understanding, and applying and higher-order thinking skills: analyzing, evaluating, and creating (Churches, 2008).

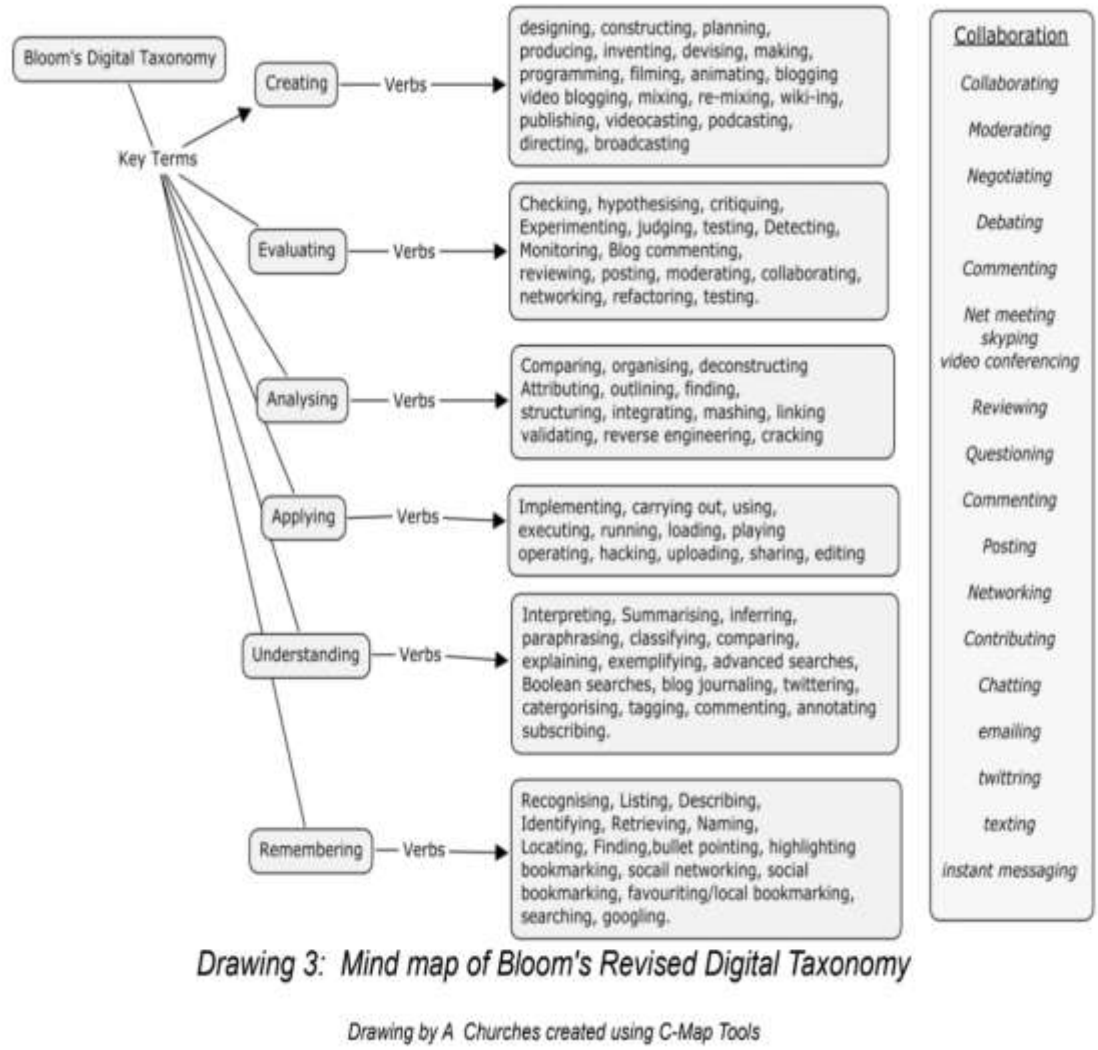

Figure 3. Mind Map of Bloom's Revised Digital Taxonomy [A mindmap of elements and digital verbs within Bloom's Revised Digital Taxonomy. Retrieved from http://burtonslifelearning.pbworks.com/f/BloomDigitalTaxonomy2001.pdf. Reprinted with permission from Andrew Churches.]

In an effort to align current teaching practices with the integration of technology and reach today's students, the IPI and IPI-T process assists in the collection of data to get an insight into how students are cognitively engaged in the learning during the instructional activity. The IPI and IPI-T encourages faculty members to study the data and think collaboratively about ways to work towards a balance of higher and lower levels of student cognitive engagement through incremental changes in instructional practice (Dennis, 2013). Categories 6 and 5 include learning activities that fall within the higher-order, deeper thinking spectrum of Bloom's Taxonomy and Bloom's Digital Taxonomy such as analysis and creating while Categories 4, 3, and 2 include lower-order, surface thinking activities such as recalling simple facts and googling for answers.

Description of the Instructional Practice Inventory

In 1995 a professor at the University of Missouri, named Jerry Valentine along with a graduate research assistant, Brian Painter developed the Instructional Practice Inventory (IPI) process. They set out to create a tool that would document "the degree of change in engagement and instruction" during a two-year school improvement project. The project included 10 elementary, 10 middle, and 10 high schools across Missouri. An interesting fact surfaced after using the IPI process from 1996-98 with the targeted schools, when faculty participated collaboratively and studied the data to problem solve the meaning of the data, they were said to have made greater gains instructionally than the faculty that did not collaboratively study their data. The IPI evolved from being a tool to collect data to understand and study the degree of student engagement into a "process of data collection and collaborative study". In 1998-2002 the IPI was used to support school improvement in other Missouri school as well as nationally recognized middle schools. In 2002 a set of protocols and standards were developed to support professional development and the implementation of the IPI process in additional schools. Since its development, more than 22,000 educators have participated in and completed the IPI Level 1 Workshop. Upon completion, educators are certified as IPI data collectors as well as facilitators, enabling them to lead collaborative study sessions (Valentine, "User Requirements," n.d.).

Instructional Practice Inventory Process

The IPI process is led by teacher-leaders and carried out school-wide to collect data about student engagement. Shortly after the collection of data the teacher-leaders facilitate faculty collaborative sessions in an effort to disseminate the data and participate in collaborative conversations. The process includes informing faculty of the six categories associated with student cognitive engagement so faculty who study the profiles will view the data as a fair and accurate representation of engagement within classrooms. All faculty have the opportunity to reflect upon the data and deepen their understanding of how to most effectively engage students in their respective classrooms (Valentine, 2012c). It is important to note the IPI process is not used for evaluative purposes or by district administrators. In addition, during the data collection process individual teachers are not noted but rather the observation number, class period, subject, and whether the class is part of the core courses or non-core courses.

Instructional Practices Inventory Categories

The IPI Categories are represented numerically (see Appendix A). Each category describes the level of student engagement and are referred to as:

1. Student Active Engaged Learning (Category 6): Students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking, creativity, and/or synthesis. Engagement in learning is not driven by verbal interaction with peers, even in a group setting. Examples of classroom practices commonly associated with higher-order/deeper Active Engaged Learning include: inquiry-based approaches such as project-based and problem-based learning; research and discovery/exploratory learning; authentic demonstrations; independent metacognition, reflective journaling, and self-assessment; and, higher-order responses to higher-order questions.
2. Student Verbal Learning Conversations (Category 5): Students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking, creativity, and/or synthesis. The higher-order/deeper thinking is driven by peer verbal interaction. Examples of classroom practices commonly associated with higher-order/deeper Verbal Learning Conversations include: collaborative or cooperative learning; peer tutoring, debate, and questioning; partner research and discovery/exploratory learning; Socratic learning; and, small group or whole class analysis and problem solving, metacognition, reflective journaling, and self-assessment. Conversations may be teacher stimulated but are not teacher dominated.
3. Teacher-led Instruction (Category 4): Students are attentive to teacher-led instruction as the teacher leads the learning experience by disseminating the appropriate content

knowledge and/or directions for learning. The teacher provides basic content explanations, tells or explains new information or skills, and verbally directs the learning. Examples of classroom practices commonly associated with Teacher-Led Instruction include: teacher dominated question/answer; teacher lecture or verbal explanations; teacher direction giving; and, teacher demonstrations. Discussions may occur, but instruction and ideas come primarily from the teacher. Student higher order/deeper learning is not evident.

4. Student Work with Teacher Engaged (Category 3): Students are engaged in independent or group work designed to build basic understanding, new knowledge, and/or pertinent skills. Examples of classroom practices commonly associated with Student Work with Teacher Engaged include: basic fact finding; building skill or understanding through practice, 'seatwork', worksheets, chapter review questions; and multi-media with teacher viewing media with students. The teacher is attentive to, engaged with, or supportive of the students. Student higher-order/deeper learning is not evident.

5. Student Work with Teacher Not Engaged (Category 2): This category is the same as Category 3 except the teacher is not attentive to, engaged with, or supportive of the students. The teacher may be out of the room, working at the computer, grading papers, or in some form engaged in work not directly associated with the students' learning. Student higher-order/deeper thinking is not evident.

6. Student Disengagement (Category 1): Students are not engaged in learning directly related to the curriculum.

The categories are not a hierarchy but rather "six distinct ways to categorize student engagement" (Valentine, 2017). Categories 6 and 5 include learning activities that fall within the higher-order/deeper thinking spectrum of Bloom's Taxonomy such as analysis and critical thinking while categories 4, 3, and 2 include lower-order surface thinking activities such as recalling simple facts.

Description of the Instructional Practice Inventory Level I Basic Workshop

The goal is for participants in the IPI Level I Basic Workshop to gain the skills to "document student engagement using a six-category observation system": (a) two categories document the frequency with which students are engaged in higher-order/deeper thinking during learning time; (b) another category assesses the degree of student attentiveness during teacher-led instruction; (c) two categories assess the degree to which students are engaged during seatwork, practice, skill development and other forms of surface learning; (d) and, one category documents the degree to which students are disengaged during learning time (Valentine, 2012c). All data collectors and facilitators of the faculty collaborative study of the data are required to have successfully completed an IPI Level 1 Workshop. The workshop is eight hours and designed to prepare teacher-leaders to collect IPI data within their own schools with "validity, reliability, and inter-rater reliability as well as develop strategies for leading the faculty in the collaborative study of the data" (Valentine, 2012c).

Description of the Instructional Practice Inventory – Technology

Early discussions in 2010-2011 among Valentine, technology specialists, teachers, and school leaders, already using the IPI data collection process, led to the piloting and field testing in 2011-12 of the IPI-T data collection process. The IPI-T is an 'add-on' component designed for schools that have experience with the IPI process and are currently 1:1 (one technology device per student) or planning to soon become 1:1 or high-tech schools. The IPI-T process builds upon the work of the basic IPI process and provides additional data that allow the faculty to understand student cognitive engagement when technology is being used to support the learning experience as compared to classes when technology is not associated with the learning experience. Additional components are documented as well: (a) how technology is being used to support learning; (b) the type of technology used to support the learning experience; (c) the designer of the technology; (d) the primary user of the technology, the teacher or student. Data can be disaggregated by faculty multiple ways to match their goals for student cognitive engagement (Valentine, 2015a; Valentine, 2015b).

Instructional Practices Inventory- Technology Process

The IPI-T process has been designed to be led by teachers and carried out school-wide to collect data about student cognitive engagement, how students are thinking when using technology. Shortly after the collection of data the teacher-leaders facilitate faculty collaborative sessions in an effort to disaggregate the data and participate in collaborative conversations. In comparison to the IPI process the IPI data collection protocols for collecting basic IPI data are followed when the IPI-Technology Component is added. The observation/data collection process, however, is more complex. In the IPI-T process, the data collector documents the total number of students and the numbers using and not using technology and makes two IPI engagement codes, one for all students and one for ‘only the tech students’. The data collector also documents how technology is being used for learning (see Appendix B). Once again it is important to note neither the IPI or IPI-T process should not be used for evaluative purposes or by district administrators. In addition, during the data collection process individual teachers are not noted but rather the observation number, class period, subject, and whether the class is part of the core courses or non-core courses. All persons being observed remain anonymous (Valentine, 2015a).

Instructional Practices Inventory- Technology Categories

There are six IPI-T categories. Each category describes the level of student cognitive engagement and are referred to as (1) Student Disengagement; (2) Student Work with Teacher Not Engaged; (3) Student Work with Teacher Engaged; (4) Teacher-led Instruction; (5) Student Verbal Learning Conversations; (6) Student Active Engaged Learning. The IPI and the IPI-T both utilize each of the six categories. It is important to note that the categories are not considered a hierarchy but rather “six distinct ways to categorize student engagement” (Valentine, 2017). Categories 6 and 5 include learning activities that fall within the higher-order, deeper thinking spectrum of Bloom’s Taxonomy and Bloom’s Digital Taxonomy such as analysis and creating while Categories 4, 3, and 2 include lower-order, surface thinking activities such as recalling simple facts and googling for answers.

Tech-Use Categories and Definitions

Following is a brief explanation of the Tech-Use Categories and definitions (see Appendix C). The categories provide faculty with details about how students are cognitively engaged for each form of tech use.

1. Word Processing. The students are using technology to produce written documents. This category includes note taking, composing papers, editing, formatting, and printing the written material.

2. Math Computations. The students are using technology to perform mathematical computations. This category includes calculating, charting, and plotting with hand-held calculators, spreadsheets, and statistical formulae.

3. Media Development. The students are using technology to collect, manipulate, and/or create media. This category includes the use of technology to collect, edit, and/or design photo, video, and/or audio data and presentations, as well as programming, writing code, and web development.

4. Information Search. The students are using technology to search and/or gather information for their learning task. This category includes the use of the Web and/or other media to access facts, information, and/or insights available through the use of technology.

5. Collaboration among Individuals. The students are using technology to interact with and/or collaborate with others to accomplish their learning task. This category includes the use technology for all forms of synchronous (same time, usually verbal), communication and many forms of near-synchronous (intermittent or streamed, usually text chat) communication.

6. Experience-Based Immersion Learning. The students are using technology to engage in a tech-driven, immersion learning experience. This category includes the use of technology to engage students in game-based software, intense interactive simulations, and virtual reality associated with classroom learning goals.

7. Interactive/Presentation Technology. The students and/or teacher are using an interactive or presentation tech tool to support the learning task. This category includes us of software that supports the transfer of information among students and between students and teachers.

8. Other. Occasionally the data collector may determine that none of the seven options adequately describe how students are using technology. This “other” option should be marked if that is the case. However, selection of this “other” option is extremely unusual.

The first set of codes was collected within the targeted high school as a pilot of the measurement tool in the fall of 2017, shortly after the purchase of Chromebooks. The researcher noticed after 217 observations of 27 high school classrooms, 95 observations were coded as students using technology and 59 observations were coded as teachers using technology. When observed using technology, students were engaged in lower-order, surface thinking activities 58.9% of the time. Coding took place four times during the 2017-18 school year, collecting 217 codes. Overtime, the researcher noticed technology use by the teacher decreased slightly, increasing student use of technology, but disengagement increased dramatically as did the integration of activities that fall within Categories 4, 3, and 2 on the IPI-T. This is not surprising as the researcher did not implement the IPI-T process with fidelity. Valentine (2012b) stated, "The greater the implementation integrity to these strategies, the greater the likelihood the school will see positive academic results from their use of the IPI" (p. 1). Missing from the process during the 2017-18 pilot of the IPI-T was the implementation of faculty collaboration sessions. The sessions provide faculty with time to study the data after each data collection, engage faculty in reflecting about the data, create collaborative learning experiences to build new knowledge, and allows faculty voice in establishing annual cognitive engagement goals.

Description of the Instructional Practices Inventory - Technology Workshop

The IPI Level I Basic Workshop and the IPI-T Component Workshop are both full-day workshops. In the IPI Level I Workshop participants gain the skills to "document student engagement using a six-category observation system" (Valentine, 2012a). The IPI-T Component Workshop does not teach participants how to code the six IPI categories due to time constraints and the necessary time needed to teach the IPI process as well as the IPI-T process. Therefore, all participants in the IPI-T Component Workshop must have successfully completed the IPI Level I Workshop with an accuracy score of .80 or higher (Valentine, 2015a). During the IPI-T Component Workshop, technology is used to view practice examples and to understand the data coding, data entry, and data reporting spreadsheets that accompany the IPI-T process. Coding skills are developed via practice examples and guided practice in classrooms in which technology is being used to support learning. Data collection reliability is the data collector's accuracy across multiple similar observations. This means when a data collector sees student engagement of a particular type (both in the IPI and IPI-T coding process) at two different times (8:00 a.m. and again at 2:00 p.m.) the observer is making the same (correct) code for the two scenarios. During the IPI Level I Workshop and the IPI-T Component Workshop participants complete 40 to 50 practices codes. Each coding scenarios can be very different in nature to highly similar. Scenarios provided cover different classroom learning contexts as well as a variety of grade levels in an effort to establish coder's consistent competence ("Users Requirements" n.d.). The process for developing the data collector's validity, reliability, and inter-rater reliability during is the central focus during both IPI Level I Basic Workshop and the IPI-T Component Workshop. Participants are given multiple scenarios to code independently and then share out with the entire workshop participants in to allow each participant to recognize their growth in coding throughout the day but also to realize they are growing together and building inter-rater reliability as they work together. This transformation is crucial in the IPI and IPI-T learning process because data collectors must have confidence that their colleagues who are collecting data are coding just as accurately as they are throughout the school day ("Users Requirements" n.d.).

Description of Faculty Collaborative Study Sessions

According to Valentine (2017), "When IPI/IPI-T data are collected for the purposes of school improvement, all teachers should have the opportunity to study the data and reflect upon their perceptions of effective learning/instructions" (p. 3). Faculty should converse about best practices and the value of the six categories. Once a baseline is established, discussions about how to change the engagement profiles over time should occur to ensure instructional design and teaching practices evolve. Profiles of many schools have been collected by Valentine. His findings indicate that conversations about the IPI/IPI-T data should take place in a setting of "trust and inquiry, where teachers can be open, not defensive, about profile data" (Valentine, 2017). Valentine, (2017) suggested when studying the data faculty should be reminded the data represent a 'snapshot in time' of the entire school's learning experiences, secondly the six categories are 'discreet' not 'continuous', categories three through six are of value of different times throughout the lesson, next the six categories are not a hierarchy, and finally the six categories are distinct ways to categorize student cognitive engagement. Strategies prescribed by Dr. Jerry Valentine (2012b) include:

1. Create a school IPI-T team
2. Educate the faculty about the process
3. Support the IPI-T team and the process
4. Collect data multiple times per school year
5. Inform the faculty of upcoming data collections
6. Collect systematic, proportionate samples
7. Meet as a faculty to study the data after each data collection

8. Engage the faculty in reflecting about the data collection day
9. Engage the faculty in comparisons of the data
10. Create collaborative learning experiences to build new knowledge
11. Disaggregate data per faculty requests
12. Establish annual cognitive engagement goals which support higher-order deeper thinking skills
13. Arrange the setting for collaborative faculty learning
14. Understand faculty perspectives and progress accordingly

The first data collection profile should serve as baseline data and future data collections provide longitudinal perspectives of engaged learning for the school. Valentine (2017) recommends each school collect data four times each school year to achieve optimum impact. Teacher leaders collecting the data should engage faculty in studying the data to identify patterns, trends, and changes in each data profile as well as establish and deliver purposeful professional development and continuous conversations. Valentine (2017) stated, “To make a difference in student cognitive engagement, the faculty IPI/IPI-T collaborative conversations must progress from merely studying profile percentages to learning discussions that deepen knowledge, build a commitment to refinement of instructional practices, particularly increasing higher-order/deeper thinking time and reducing disengagement during class time” (p. 3). Valentine (2012c) has collected tens of thousands of codes, educating more than 23,000 educators in the IPI-T data collection process. Valentine (2012c) explained, “Findings from our quantitative studies of the relationships between IPI-T cognitive engagement data and achievement parallel findings from other studies of the past two to three decades, i.e. increasing engagement and higher-order deeper thinking during learning time and conversely reducing disengagement during learning time positively influence student academic success” (p. 1). The IPI-T was created through the collaborative discussions among Dr. Jerry Valentine, technology specialists, teachers, and school leaders in an effort to address the growing use of technology in the classroom. The IPI-T was built upon the work of the basic IPI process to provide faculty with additional data to understand student cognitive engagement when technology is being used in the classroom. It is a walkthrough observation process designed to collect data concerning how often and in what ways teachers are integrating technology as well as how often students are cognitively engaged in higher-order, deeper (HO/D) thinking as well as lower-order, surface (LO/S) thinking. The implementation of the IPI-T process includes engaging faculty in collaborative sessions within one week after each data collection. Faculty collaborative sessions allow all faculty to reflect about the data and establish cognitive engagement goals. Implementing the entire IPI-T with fidelity increases the likelihood that the targeted schools will see a positive influence on student achievement as they move toward a 1:1 environment.

Summary

Chapter 2 is an exhaustive review of the literature looking at today's students, Generation Z and Alpha. Also, a historical and thorough description of the IPI and IPI-T process and categories is provided. Next is a look at the transformation of Bloom's Taxonomy to what we know now as Bloom's Digital Taxonomy, as well as an examination of experiences with technology among students and teachers. Finally, an explanation of how the IPI and IPI-T process, including the implementation of the Faculty Collaborative Sessions, have been used to breakdown the barrier to technology use and increase student cognitive engagement and higher-order thinking.

Research Questions

The guiding questions for this research study are as follows. Research Questions 1-4 are quantitative. Research Questions 5-6 are qualitative. Research Question 7 is mixed method.

1. To what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?

   Ho: Participating in faculty collaborative study sessions has no effect on faculty's technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T)

   Ha: Participating in faculty collaborative study sessions does affect faculty's technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T)

2. To what extent does participation in faculty collaborative study sessions affect student's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?

Ho: Participating in faculty collaborative study sessions has no effect on students' technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T)

Ha: Participating in faculty collaborative study sessions does affect students' technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T)

3. What categories of technology use, as defined by the IPI-T, are most frequently used in 9-12 classrooms within the targeted district?

4. What categories of technology use, as defined by the IPI-T, are most frequently coded when student cognitive engagement codes 5 and 6 are recorded?

5. How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect the teacher's use of technology use in the classroom?

6. How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect students' use of technology use in the classroom?

7. How does the qualitative follow-up data help us to better understand the quantitative first-phase results?

Citation

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CHAPTER 3:

RESEARCH DESIGN, DATA COLLECTION, AND ANALYSIS PROCEDURES

Overview

The purpose of this explanatory-sequential mixed methods study was to assess the impact of the IPI-T process on technology use and student cognitive engagement. The goal was to implement all strategies, including faculty collaborative study sessions four times per year to support teacher implementation of new technology to increase higher-order, deeper thinking by students and increase student use of technology. The impact was measured by comparing IPI-T data codes of those faculty that participate in the faculty collaborative study sessions with baseline data prior to the implementation of the faculty collaborative study sessions as well as participant responses from a web-based questionnaire created by the researcher. The design employed was an explanatory-sequential mixed methods approach. The explanatory-sequential approach allowed the researcher to look at key results in more detail, assuming either surprising or unexpected results may occur in the quantitative phase of the study. The additional collection of qualitative data helped to further understand the results (Creswell, 2015). Qualitative data collection followed the quantitative phase with priority or emphasis placed on the quantitative results. The quantitative portion of this study used the IPI-T instrument, a pre-determined and numerically coded instrument, to collect data concerning the frequency and scale of student cognitive engagement as technology is integrated into the classroom (Larinee, 2003; Valentine 2015c). Observational data collected using the IPI-T was recorded numerically for analysis and interpretation through descriptive and inferential statistics (Valentine 2015c). Data collected from the qualitative strand was analyzed for themes and then because the data was collected in sequence, findings were associated with the quantitative results of the IPI-T to determine how and why the data converged.

A web-based questionnaire, created by the researcher, was used to collect qualitative data. The questionnaire consisted of both closed-ended and open-ended questions. According to Creswell (2015), there is an advantage to creating a questionnaire with both closed and open-ended questions. The closed-ended questions are predetermined and can "net useful information to support theories and concepts in the literature" (Creswell, 2015, p. 219). Those participating in the qualitative phase and responding to the questionnaire included eight faculty members, four representing core courses, and four representing non-core courses. Prior to sharing the questionnaire with participants two committees participated in the creation and validation of the questions. A formative committee made up of three members from the IPI-T data collection team assisted in the formation and revision of the questions. In addition, three experts from the field served as the summative committed to validate the survey. The experts included the creators of the IPI-T instrument, as well as a Research Associate from Rockman et al. Finally, prior to surveying participants, two classroom teachers and one instructional coach trained in the collection of IPI-T data piloted the survey.

Participants

The research participants are employed within a school district located in southern, rural Iowa. The district includes five buildings: (a) preschool; (b) kindergarten and first grade; (c) second through fifth grade; (d) the middle school which houses students in grades six through eight; (e) the high school, grades nine through twelve. This research study involved only the high school, grades 9-12 because technology is nearly one device per two students.

Quantitative

A nonprobability sampling approach was utilized. Popular approaches in nonprobability sampling are convenience and snowballing sampling approaches (Creswell, 2015). A convenience sampling strategy was employed for the quantitative strand of the study because participants must be willing and available to participate (Creswell, 2015; Edmonds & Kennedy, 2017). Participants included 27 faculty members, 11 males and 16 females. Each participated in faculty collaborative study sessions within one week from the collection of data using the IPI-T Recorder App. A Google Form was distributed to collect demographic information such as age, ethnicity, educational level, and number of years of teaching experience. By submitting the online survey, participants consented to volunteer to participate in the study.

Qualitative

The sampling strategy for the qualitative strand was a purposeful sample, utilizing a confirming and disconfirming sampling procedure during the study to follow up on and explore specific findings (Creswell, 2015). A single person from each content area, listed on the IPI/IPI-T Data Recording Form, was identified and invited to volunteer to participate in an open-ended, web-based questionnaire. Content areas included core classes: math, science, social studies, and English and language arts, as well as non-core classes: fine and performing arts, physical education and health, vocational technology, and special education. There was a possibility of eight participants, four representing core courses, and four representing non-core courses. According to Creswell, (2015) purposeful sampling allows the researcher to select individuals or sites that are “information rich” and may provide useful information about the central phenomenon (p. 205). In addition, purposeful sampling gives freedom to the researcher to choose individuals that may otherwise be silenced but rather give them a voice (Creswell, 2015).

Instruments

Instructional Practice Inventory – Technology

The Instructional Practice Inventory – Technology (IPI-T) is a walkthrough observation tool designed to collect data concerning how often and in what ways teachers are integrating technology as well as how often students are cognitively engaged in higher order, deeper thinking and can be used to help faculty align technology standards both at grade level and content areas.

Instructional Practices Inventory- Technology Process

Led by teacher-leaders, the IPI-T process is implemented school-wide, collecting data about student cognitive engagement to show how students are thinking when using technology.

Within a week after the collection of data, the teacher-leaders facilitate faculty collaborative sessions in an effort to disaggregate the data and participate in collaborative conversations. In comparison to the IPI process, the IPI data collection protocols for collecting basic IPI data will follow when the IPI-Technology Component is added. The observation/data collection process, however, is more complex. In the IPI-T process, the data collector documents the total number of students and the numbers using and not using technology and makes two IPI engagement codes, one for all students and one for 'only the tech students'. The data collector documents how technology is being used for learning (Valentine, 2015a).

Instructional Practices Inventory-Technology Categories

There are six IPI-T categories. Each of the categories are represented numerically (see Appendix A). The six categories describe the level of student cognitive engagement and are referred to as (a) Student Disengagement; (b) Student Work with Teacher Not Engaged; (c) Student Work with Teacher Engaged; (d) Teacher-led Instruction; (e) Student Verbal Learning Conversations; (f) Student Active Engaged Learning. The IPI and the IPI-T both utilize each of these categories. It is important to note that the categories are not considered a hierarchy but rather "six distinct ways to categorize student engagement" (Valentine, 2017).

Categories 6 and 5 include learning activities that fall within the higher-order, deeper thinking spectrum of Bloom's Taxonomy and Bloom's Digital Taxonomy such as analysis and creating while Categories 4, 3, and 2 include lower-order, surface thinking activities such as recalling simple facts and googling for answers. Category 6 is coded when students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking and creativity. Likewise, Category 5 only differs from Category 6 because the higher-order, deeper thinking is driven by peer verbal interaction.

Teacher-led instruction is coded as a Category 4. Category 3 students are engaged in independent or group work designed to build basic understanding, new knowledge, and/or pertinent skills. This category is the same as Category 3 except the teacher is not attentive to, engaged with, or supportive of the students. Category 1 is associated with students not engaged in learning directly related to the curriculum.

Tech-Use Categories

According to Valentine (2015d) categories provide faculty with details about how students are cognitively engaged for each form of tech use. Following is a list of the Tech-Use Categories (see Appendix C) (1) Word Processing; (2) Math Computations; (3) Media Development; (4) Information Search; (5) Collaboration Among Individuals; (6) Experience-Based Immersion Learning; (7) Interactive Presentation Technology; and (8) Other (Valentine, 2015d).

Procedures

Research Design

The design employed was an explanatory-sequential mixed methods approach. The explanatory-sequential approach allowed the researcher to look at key results in more detail and assuming either surprising or unexpected results may occur in the quantitative phase of the study, additional collection of qualitative helped to further understand the results (Creswell, 2015). Qualitative data collection followed the quantitative phase with priority or emphasis placed on the quantitative results. The quantitative portion of this study used data from the IPI-T instrument, a pre-determined and numerically coded instrument, to collect data concerning the frequency and scale of student cognitive engagement when technology was integrated into the classroom (Larinee, 2003; Valentine 2015c). Observational data collected using the IPI-T was recorded numerically for analysis and interpretation through descriptive and inferential statistics (Valentine 2015c). Data collected from the qualitative strand was analyzed for themes and then because the data was collected in sequence, findings were associated with the quantitative results of the IPI-T to determine how and why the data converged.

Quantitative Data Collection

Participation in this study was not a requirement. However, if a faculty member chose to participate, after receiving an overview of this research study, they were asked to sign a research consent form. Each participant was given a signed copy of this form to keep. In addition to the general consent form, consent was sought at the district level, requiring approval from the district's superintendent. IPI-T data collection process required 3-5 minutes in the classroom for the IPI data collection process and these additional steps:

Before entering the learning setting the researcher:

1. Recorded the *Page Number* at the top right portion of the Data Recording Form.

2. Recorded the *Observation Number* on the upcoming observation.

Upon entry into the learning setting the researcher:

3. Made a whole-class mental snapshot of student engagement, same as when collecting basic IPI data.

During the time in the learning setting the researcher:

4. Took an entry snapshot, worked the learning setting, moved among the students and talked with the students and teacher, if necessary, to obtain the specific details of the big picture snapshot taken upon entry. Next, a determination was made of the IPI Category that most appropriately defined student cognitive engagement for that learning setting. The IPI data collection protocols explained in the basic IPI Workshop govern both the IPI and IPI-T category codes. The researcher left the learning setting before recording the student engagement codes for both the IPI and IPI-T student engagement category codes.

5. Counted and recorded the total number of students in the learning setting during or immediately after leaving the learning setting.

6. Counted and recorded the number of students (if any) who were disengaged in the learning task(s) during or immediately after leaving the learning setting.

7. Counted and recorded the number of students (if any) who were using technology (and those who are supposed to be using technology) as part of their learning experience. Verified the total number of tech users and supposed-to-be users during or immediately after leaving the learning setting.

8. Counted and recorded the number of students who were supposed to be using technology but were disengaged from the learning task(s) during or immediately after leaving the learning setting.

Determined the IPI-T tech use category:

9. During the time spent in the learning setting (classroom) it was necessary to determine student head counts and IPI/IPI-T Codes. In addition, the researcher

determined how technology was being used by the students or by the teacher if only the tech user was the teacher.

10. The IPI-T Tech-Use Categories provided the faculty with details about how students were cognitively engaged for each form of Tech Use. Therefore, the data collector identified the Tech-Use Category that represented how the greatest number (most) of the "technology engaged" students were using technology (or, how the teacher was using technology if the teacher was the only user of the technology and no students were actively engaged in the use of technology). The Tech Use Category number is recorded on the Data Recording Form. When students were using technology in multiple ways, the data collector counted the varied uses and then selected the Tech Use Category most frequently used. Data collectors were encouraged to record information and make margin notes if needed. If no students were using, or supposed to be using technology, "0" was recorded in the appropriate locations on the Data Recording Form.

After leaving the learning setting the researcher:

11. Determined the primary user of the technology. Student use carries precedent in the coding process over teacher use for identifying the Tech-Use Category (i.e. if students and the teacher were using technology, student use, not teacher use, was recorded). For student use, the technology must be fostering active/direct student engagement, not passive engagement. For example, if the teacher was writing information from the students on a SMART Board, the teacher was the primary user of the technology, not the students. If the students were using their technology to engage with the learning task, then the students were the primary user of technology. If the teacher was the tech user (and no students are using tech) an IPI-T Category code was not given. Only student use generated a cognitive IPI-T engagement code.

12. Determined the producer/developer of the technology. Coded "1" if the tech being used was developed commercially specifically for education; "2" if the teacher developed the technology or modified existing technology to personalize the learning experience for the students; "3" if a student(s) developed the technology being used to support learning; or, "4" if the technology was developed commercially and not specifically for education. If the teacher influenced the learning experience (left a thumbprint) then the teacher was given credit as a producer/developer. Thus, teachers can understand student cognitive engagement when they have/have not personalized the technology for their students.

Finally, the researcher will double checked each row to be sure to have either marked a code for all cells or placed a “line” through items on the row that did not need a code.

Qualitative Data Collection

Upon institutional review board approval, eight participants, four representing core courses, and four representing non-core courses were informed about the study face-to-face. They learned about the purpose of the study as well as what to expect if they chose to participate. Once participants agreed they were asked to complete an informed consent form prior to participating. After the consent forms were complete, the eight participants responded to an open-ended, web-based questionnaire created using Google Forms. The questionnaire was distributed during the final faculty collaborative session to only those that agreed to participate.

Quantitative Data Analysis

An explanatory-sequential mixed method design was employed. The quantitative method was a quasi-experimental within-subjects approach utilizing a pretest and posttest design. Inferential statistics were used to analyze the nominal data collected from the IPI-T to test the null hypothesis using the parametric statistic of analysis of variance (ANOVA). According to Creswell, (2015) descriptive statistics describe general tendencies in the data such as mean, median, and mode and are used to summarize, organize and simplify the nominal data. In addition to inferential statistics, descriptive statistics will be used to organize the nominal data in a frequency distribution table to answer descriptive research questions three and four.
The ANOVA is the inferential statistics technique chosen for this quantitative study because the test analyzes main effects of the independent variable on the outcome or dependent variable as well as interactive effects. (Creswell, 2015; Reeves, n.d.). The ANOVA is a parametric test and will be used to analyze main effects of participation in faculty collaborative sessions and the effect on IPI-T student cognitive engagement codes. Table 1 shows each research question and the corresponding statistical analysis that will be used for the study. Research questions 3 and 4 will employ descriptive statistics to report the frequency for each IPI-T category of technology use and student cognitive engagement codes. Research questions 1 and 2 will utilize the ANOVA. Contingency tables were created

to organize the categorical variables and make it easier to understand the null hypothesis (Reeves, n.d.). The contingency tables for research question 1-4 can be found in Tables 2, 3, 4, and 5.

Table 1. Research Questions and Corresponding Statistical Analysis Methods

Research Questions	Statistical Analysis
1. To what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?	ANOVA*
2. To what extent does participation in faculty collaborative study sessions affect students' technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?	ANOVA*
3. What categories of technology use, as defined by the IPI-T, are most frequently used in 9-12 classrooms within the targeted district?	Descriptive statistics
4. What categories of technology us, as defined by the IPI-T, are more frequently coded when student cognitive engagement codes 5 and 6 are recorded?	Descriptive statistics

**Note*. Inferential statistics.

Research question one is addressed when participants are asked, *to what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?* The ANOVA analysis was utilized to calculate the strength or effect size between faculty's use of technology IPI-T engagement categories and participating in the faculty collaborative study sessions. In other words, do the IPI-T codes of teacher use of technology IPI-T engagement categories reveal statistical significance as a result of participating in the faculty collaborative study sessions? The null hypothesis for this research question states that there is no difference in faculty's technology use as measured by codes on the IPI-T of those that participated in the faculty collaborative sessions (see Table 2).

Table 2. Contingency Table for Research Question 1 & 2

Faculty Collaborative Session	IPI-T Engagement Codes					
	1	2	3	4	5	6
Baseline						
One						
Two						
Three						
Four						

Note. Frequency distribution of faculty's use of technology IPI-T engagement categories.

Research question two asks, *to what extent does participation in faculty collaborative study sessions affect students' technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?* The ANOVA analysis was utilized to calculate the strength or effect size between faculty's use of technology IPI-T engagement categories and participating in the faculty collaborative study sessions. In other words, do the IPI-T codes of student use of technology IPI-T engagement categories reveal statistical significance as a result of faculty participating in the faculty collaborative study sessions? The null hypothesis for this research question states that participating in faculty collaborative study sessions has no effect on student's technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T) (see Table 2).

Research question three asks, *what categories of technology use, as defined by the IPI-T, are most frequently used in 9-12 classrooms within the targeted district?* (see Table 3). Descriptive statistics will be used to organize the nominal data in a frequency distribution table to answer descriptive research question three. Research question four asks, *what category of technology use, as defined by the IPI-T, are most frequently coded when student engagement codes 5 and 6 are recorded?* (see Table 3). Descriptive statistics will be used to organize the nominal data in a frequency distribution table to answer descriptive research question four.

Table 3. Contingency Table for Research Question 3 & 4

Category of Technology Use	IPI-T Engagement Categories					
	1	2	3	4	5	6
Word Processing						
Math Computations						
Media Development						
Information Search						
Collaboration Among Individuals						
Experience-Based Technology						
Interactive/Presentation Technology						
Other						

Note. IPI-T engagement categories associated with categories of tech use.

Qualitative Data Analysis

Table 4 shows each qualitative research question, possible responses, and the type of question: closed-ended or open-ended. Using Google Forms, a web-based questionnaire was created. According to Creswell (2015), there is an advantage to creating a questionnaire with both closed and open-ended questions. The closed-ended questions are predetermined and can "net useful information to support theories and concepts in the literature" (Creswell, 2015, p. 219). Sub-questions a, c, and e were followed by an open-ended question to explore reasons behind the participant's responses (see Table 4).

This study is based on an explanatory-sequential approach. Using the participant-selection design, quantitative data was collected, analyzed, and the results were interpreted. Next the participants were selected for the qualitative phase using a means of purposeful sampling. Following selection of participants, qualitative data was collected, analyzed, and the results were interpreted (Edmonds & Kennedy, 2017). Looking for overlapping themes within the open-ended questions, the researcher counted and recorded themes or the number of times that the participants mention particular themes. This self-designed protocol assisted in the organization of information reported by each participant to each question (Creswell, 2015). Finally, both quantitative and qualitative data were interpreted to determine how and why the data converged (Edmonds & Kennedy, 2017).

Table 4.Qualitative Questions on Web-Based Questionnaire

Qualitative Questions	Type
1. Did you participate in all faculty collaborative study sessions?	Closed-ended
2. "Participating in faculty collaborative study sessions affected my use of technology in my classroom." ____________ Do you strongly agree? ____________ Do you agree? ____________ Are you undecided? ____________ Do you disagree? ____________ Do you strongly disagree?	Closed-ended
3. Please explain your response in more detail.	Open-ended
4. "Participating in faculty collaborative study sessions affected my students' use of technology in my classroom." ____________ Do you strongly agree? ____________ Do you agree? ____________ Are you undecided? ____________ Do you disagree? ____________ Do you strongly disagree?	Closed-ended
5. Please explain your response in more detail.	Open-ended

Note. Distributed face-to-face during final faculty collaborative session.

Data Integration

Data collected during the quantitative phase was the emphasis of this study. After identifying themes, the qualitative strand was analyzed and then because the data was collected in sequence, findings were associated with the quantitative results of the IPI-T to determine how and why the data converged. In addition, the researcher used the qualitative data to explore any key results found when collecting quantitative data that lead to the acceptance or rejection of the null hypothesis. Trustworthiness of the qualitative data was achieved through triangulation of the data. The nature of this explanatory sequential mixed method design included the best of both quantitative and qualitative data to inform or cast light on the topic of study and to valid claims that arose from the study (Creswell, 2015; Olsen, 2004).

Limitations

When conducting this explanatory sequential mixed method design the quantitative phase of the study was conducted first and followed up with the qualitative phase (Creswell, 2015; Edmonds & Kennedy, 2017). A difficulty using this design was that the researcher needed to decide which aspect of the quantitative results to follow-up on using qualitative data (Creswell, 2015). In addition, participants were chosen during the second, qualitative phase. The questions created for the second phase needed to build-on the quantitative phase in an effort to further understand the results (Creswell, 2015). This design was labor intensive because the researcher collected and analyzed two types of data, quantitative and qualitative.

According to Edmonds and Kennedy, (2017) "Major challenges when conducting research are often related to access to participants and an inability to randomly assign the participants to conditions" (p. 57). For this reason, the researcher chose to employ a quasi-experimental within-subjects approach utilizing a pretest and posttest design. The major difference between experimental and quasi-experimental is the "level of control and assignment to conditions" (Edmonds & Kennedy, 2017, p. 33). One group participated in this study. A convenience sampling strategy was employed for the quantitative strand of the study because participants were willing and available to participate (Creswell, 2015; Edmonds & Kennedy, 2017). The sample of teachers chosen from the population of teachers in the district was relatively small. The targeted district employs 100 teachers, 27 are employees within the high school chosen for the study. The sampling strategy for the qualitative strand was a purposeful sample, utilizing a confirming and disconfirming sampling procedure during the study to follow up on and explore specific findings (Creswell, 2015). A subgroup of eight teachers from the sample was asked to participate in the qualitative phase. Participants from the small subgroup had the potential to provide useful information for answering questions and hypotheses, however, it is difficult for the researcher to say with confidence that the individuals represented the entire teacher population (Creswell, 2015; Edmonds & Kennedy, 2017).

Additional disadvantages to this approach were threats to internal validity which include maturation and history because the study took place over the course of several months (Edmonds & Kennedy, 2017). Edmonds and Kennedy (2017) stated, “Maturation is the natural process of changing, growing, and learning over time” and “History is any event that occurs during the time of the treatment and the posttest that could affect the outcome (e.g., natural life events such as a death in the family, change in job, or moving)” (p. 7). Further, an assumption is observations represented typical school days, and that teachers did not alter instruction when the IPI-T data collection team was present.

While the possibility of observer bias exists, training was provided to all teacher leaders who collected codes in an effort to standardize data collection. It is important to know that the process for developing the data collector’s validity, reliability, and inter-rater reliability during was the central focus during both IPI Level I Basic Workshop and the IPI-T Component Workshop. Participants were given multiple scenarios to code independently and then share out with the entire workshop participants in order to allow each participant to recognize their growth in coding throughout the day but also to realize they were growing together and building inter-rater reliability as they worked together. This transformation was crucial in the IPI and IPI-T learning process because data collectors must have confidence that their colleagues who are collecting data are coding just as accurately as they were throughout the school day (“Users Requirements” n.d.).

Upon the conclusion of each IPI-T workshop participants were required to complete a Reliability Assessment. The assessment results were sent directly to the participant and were not shared with others. Reliability ratings were used to gauge how each individual was able to participate in the IPI-T process (“Users Requirements” n.d.):

1. A reliability score of .90 or higher was necessary for permission to use the IPI-T Process for research purposes.
2. A reliability score of .80 or higher was necessary for permission to use the IPI-Process for internal use within a school or district to collect data for faculty study for school improvement.

3. A reliability score .70-.79 indicated the IPI-T Process may be used for personal or informal use only – not for research or to use in school improvement.
4. A reliability score below .70 indicated the IPI-T Process should not be used for data collection.

The researcher earned a reliability score of .95 on the IPI assessment and .98 on the IPI-T assessment. Each member on the data collecting team completed the IPI Level I Basic Workshop and IPI-T Component Workshop and earned a reliability score higher than .90 on both the IPI and IPI-T assessment (J. Valentine, personal communication, October 4, 2017).

Citation

Wallace-Spurgin, M. (2019). Research design, data collection, and analysis procedures. In I. Sahin & V. Akerson (Eds.), *Measuring student cognitive engagement when using technology* (pp. 36-50). Monument, CO, USA: ISTES Organization.

CHAPTER 4:

RESEARCH FINDINGS

In Chapter 3, the data collection and analysis procedures and research design were presented. The quantitative phase of the study used the IPI-T data collection tool and the qualitative phase utilized a questionnaire. Representing both core and non-core courses, eight participants completed the web-based questionnaire during the final faculty collaborative session. Data collected during the quantitative phase was the emphasis of this study and were used to answer Research Questions 1-4. Research Questions 5-6 were answered during the qualitative phase of the study. After identifying themes, the findings were analyzed and associated with the quantitative results of the IPI-T to determine how and why the data converged to answer Research Question 7. Also, the qualitative data were used to explore key results found when collecting quantitative data. Following are the research questions:

1. To what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?
2. To what extent does participation in faculty collaborative study sessions affect student's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?
3. What categories of technology use, as defined by the IPI-T, are most frequently used in 9-12 classrooms within the targeted district?
4. What categories of technology use, as defined by the IPI-T, are most frequently coded when student cognitive engagement codes 5 and 6 are recorded?
5. How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect the teacher's use of technology use in the classroom?

6. How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect students' use of technology use in the classroom?

7. How does the qualitative follow-up data help us to better understand the quantitative first-phase results?

Participants were faculty members employed within a school district located in southern, rural Iowa. Although the district included five buildings: (a) preschool; (b) kindergarten and first grade; (c) second through fifth grade; (d) the middle school which houses students in grades six through eight; (e) the high school, grades nine through twelve, this research study involved only the high school, grades 9-12, because technology was nearly one device per two students. Due to the nature of this mixed method study, two different sampling strategies were used for the quantitative and the qualitative strands. Participants for the quantitative phase included the entire faculty, equaling 27 participants. Of the 27 participants, 16 were females and 11 were males. The qualitative phase included eight from the 27 participants, representing four faculty members from core courses and four from non-core courses. Each subject area was represented to include: English/language arts, social studies, science, and math as well as special education, fine arts, career/technical education, and physical education. Additionally, the eight participants were made up of four females and four males. Demographic information is shown in Table 5 and 6.

Table 5. Demographics of Faculty Participants

Demographics*		*n*	%
Gender			
	Female	16	59.2
	Male	11	40.8
Core Courses			
	English/Language	4	14.8
	Arts	4	14.8
	Social Studies	3	11.1
	Math	3	11.1
	Science		
Non-Core Courses			
	Special Education	4	14.8
	Fine Arts	3	11.1
	Career/Technical Education	4	14.8
	Physical Education	2	7.5

*Note. High school faculty only (n=27)

Table 6. Demographics of Faculty Participants Taking the Questionnaire

Demographics*		*n*	%
Gender			
	Female	4	50
	Male	4	50
Core Courses			
	English/Language	1	12.5
	Arts	1	12.5
	Social Studies	1	12.5
	Math	1	12.5
	Science		
Non-Core Courses			
	Special Education	1	12.5
	Fine Arts	1	12.5
	Career/Technical Education	1	12.5
	Physical Education	1	12.5

*Note. High school faculty only identified from original sample (n=8)

Research Question 1

Research question 1 asks: *To what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?* To answer this question IPI-T data were collected. The data was analyzed using the software program the Statistical Package for Social Science (SPSS). A One-way ANOVA was performed to analyze any differences that might have existed between the variables. Results can be found in Figure 4 and Tables 7, 8, and 9.

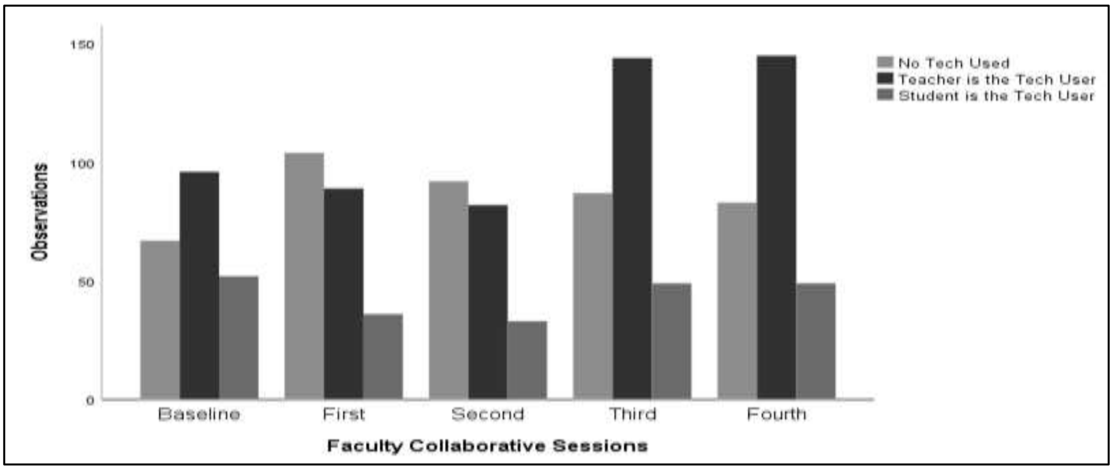

Figure 4. Observations: Teacher is the Tech User [Teacher is the technology user when IPI-T observations were conducted.]

The null hypothesis stated that faculty collaborative sessions have no effect on faculty's technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T). A One-way ANOVA revealed a significant difference among the baseline, first, second, third, and fourth faculty collaborative sessions, F (1, 1206) = 8.7, p = .003. Baseline codes for teacher use (M = .45, SD = .498) were significantly higher than the First (M = .39, SD = .489), and Second (M = .40, SD = .490) whereas Third (M = .51, SD = .501), and Fourth (M = .52, SD = .500) were significantly higher than the Baseline and Second. There was no significant difference in teacher technology use between the Baseline data and the data collected prior to the Fourth faculty collaborative session (p = .09). Consequently, the null hypothesis was rejected.

Table 7. Multiple Comparisons IPI-T Teacher Technology Use

					95% Confidence Interval	
	(J) FCS	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Baseline	First	.058	.047	.220	-.03	.15
	Second	.050	.048	.297	-.04	.15
	Third	-.068	.045	.132	-.16	.02
	Fourth	-.077	.045	.088	-.17	.01
First	Baseline	-.058	.047	.220	-.15	.03
	Second	-.007	.048	.875	-.10	.09
	Third	-.126*	.044	.005	-.21	-.04
	Fourth	-.135*	.044	.002	-.22	-.05
Second	Baseline	-.050	.048	.297	-.15	.04
	First	.007	.048	.875	-.09	.10
	Third	-.118*	.045	.009	-.21	-.03
	Fourth	-.127*	.046	.005	-.22	-.04
Third	Baseline	.068	.045	.132	-.02	.16
	First	.126*	.044	.005	.04	.21
	Second	.118*	.045	.009	.03	.21
	Fourth	-.009	.042	.827	-.09	.07
Fourth	Baseline	.077	.045	.088	-.01	.17
	First	.135*	.044	.002	.05	.22
	Second	.127*	.046	.005	.04	.22
	Third	.009	.042	.827	-.07	.09

**Note*. The mean difference is significant at the 0.05 level.

Table 8. Teacher Technology Use

					95% Confidence Interval for Mean			
FCS	N	Mean	Std. Deviation	Std. Error	Lower Bound	Higher Bound	Minimum	Maximum
Baseline	215	.45	.498	.034	.38	.51	0	1
First	229	.39	.489	.032	.33	.45	0	1
Second	207	.40	.490	.034	.33	.46	0	1
Third	280	.51	.501	.030	.46	.57	0	1
Fourth	277	.52	.500	.030	.46	.58	0	1
Total	1208	.46	.499	.014	.43	.49	0	1

Note. Teachers (n=27). FCS=Faculty Collaborative Sessions.

Table 9. ANOVA Effects of FCS* on Teacher Use of Technology

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.493	1	17.493	8.667	.003
Within Groups	2434.155	1206	2.018		
Total	2451.648	1207			

Note. $p < .05$

Research Question 2

Research question 2 asks: *To what extent does participation in faculty collaborative study sessions affect students' technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)?* To answer these questions IPI-T data were collected. The data was analyzed using the software program the Statistical Package for Social Science (SPSS). A One-way ANOVA was performed to analyze any differences that may exist between the variables Results can be found in Table 10, 11, 12, and 13. The null hypothesis stated that faculty collaborative sessions have no effect on students' technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T). A One-way ANOVA revealed a significant difference among the baseline, first, second, third, and fourth faculty collaborative sessions, F (4, 1203) = 3.4, p = .02. Baseline codes for student use (M = 1.67, *SD* = 2.17) were significantly higher than the First (*M* = 1.40, *SD* = 2.05), and Second (*M* = 1.51, *SD* = 2.21) whereas the Third (*M* = 1.81, *SD* = 2.14), and Fourth (*M* = 2.01, *SD* = 2.35) were significantly higher than the Baseline and Second. There was no significant difference in students' technology use between the Baseline data and the data collected prior to the fourth faculty collaborative session (p = .08). Consequently, the null hypothesis was rejected.

Table 10. Multiple Comparisons IPI-T Student Engagement Codes

					95% Confidence Interval	
(I) FCS	(J) FCS	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Baseline	First	.268	.208	.199	-.14	.68
	Second	.158	.214	.461	-.26	.58
	Third	-.141	.199	.479	-.53	.25
	Fourth	-.345	.199	.084	-.74	.05
First	Baseline	-.268	.208	.199	-.68	.14
	Second	-.110	.210	.600	-.52	.30
	Third	-.409*	.195	.037	-.79	-.03
	Fourth	-.613*	.196	.002	-1.00	-.23
Second	Baseline	-.158	.214	.461	-.58	.26
	First	.110	.210	.600	-.30	.52
	Third	-.299	.201	.138	-.69	.10
	Fourth	-.502*	.202	.013	-.90	-.11
Third	Baseline	.141	.199	.479	-.25	.53
	First	.409*	.195	.037	.03	.79
	Second	.299	.201	.138	-.10	.69
	Fourth	-.204	.186	.273	-.57	.16
Fourth	Baseline	.345	.199	.084	-.05	.74
	First	.613*	.196	.002	.23	1.00
	Second	.502*	.202	.013	.11	.90
	Third	.204	.186	.273	-.16	.57

**Note*. The mean difference is significant at the 0.05 level.

Table 11. Student Cognitive Engagement Codes

	IPI-T Engagement Codes for Students							
FCS	No Tech Used	Disengaged	L/O Teacher Not Engaged	L/O Teacher Engaged	Teacher Led	H/O Students Verbal	H/O Students Non-Verbal	Total
Baseline	120	4	22	26	8	9	26	215
First	140	6	25	21	5	10	22	229
Second	125	6	22	18	1	5	30	207
Third	143	6	25	45	19	12	30	280
Fourth	135	17	12	47	4	12	50	277
Total	663	39	106	157	37	48	158	1208

Note. A code is only recorded when the student is the user of technology. Students are observed multiple times during data collection. FCS=Faculty Collaborative Sessions.

Table 12. Students' Technology Use

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Higher Bound	Minimum	Maximum
Baseline	215	1.67	2.178	.149	1.38	1.96	0	6
First	229	1.40	2.059	.136	1.13	1.67	0	6
Second	207	1.51	2.207	.153	1.21	1.81	0	6
Third	280	1.81	2.139	.128	1.56	2.06	0	6
Fourth	277	2.01	2.353	.141	1.74	2.29	0	6
Total	1208	1.70	2.202	.063	1.58	1.83	0	6

Table 13. ANOVA Effects of FCS* on Student Cognitive Engagement When Using Technology

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58.681	4	14.670	3.407	.016*
Within Groups	5791.223	1203	4.814		
Total	5849.904	1207			

**Note*. FCS=Faculty Collaborative Sessions. $p < .05$.

Research Question 3

What categories of technology use, as defined by the IPI-T, are most frequently used in 9-12 classrooms within the targeted district? To answer this question IPI-T data were collected and descriptive statistics were used to organize the nominal data in a frequency distribution table as well as a bar chart. Results are show in Figure 5 and Table 14.

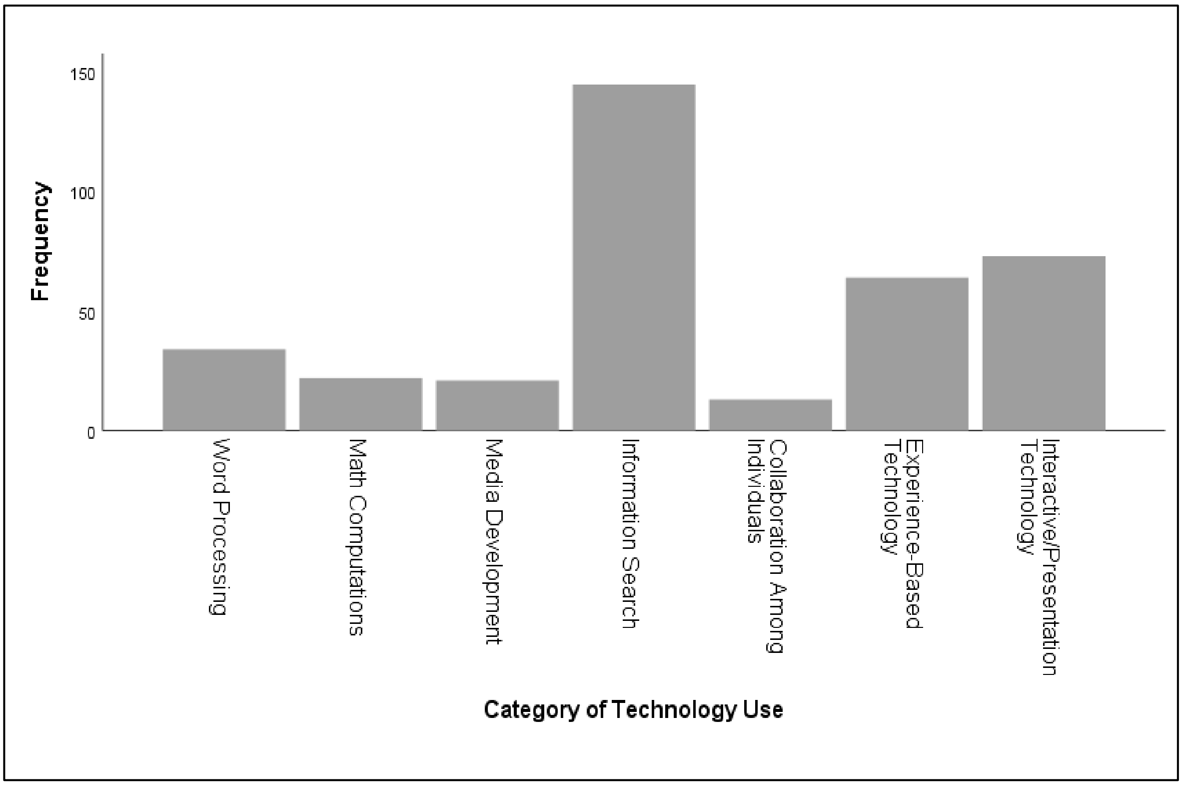

Figure 5. Frequencies of Categories of Technology Use. Categories of technology most frequently used in the classrooms observed, grades 9-12.

Table 14. Frequency of Categories of Technology Use Observed Using the IPI-T

Categories of Tech Use	Frequency*	%	Valid %	Cumulative %
Word Processing	34	9.1	9.1	9.1
Math Computations	22	5.9	5.9	5.9
Media Development	21	5.6	5.6	5.6
Information Search	145	39.0	39.0	39.0
Collaboration Among Individuals	13	3.5	3.5	3.5
Experience-Based Technology	64	17.2	17.2	17.2
Interactive/Presentation Technology	73	19.6	19.6	19.6
Total	372	100.0	100.0	100.0

*Note. Technology use by students

Data was collected using the IPI-T observational tool four times, including the collection of baseline data. A total of 372 observations were made in which students were using technology. Of the 372 observations, 145 times (39%) students were observed searching for information. According to Valentine (2015), when students are involved in information searches they are using technology to search and/or gather information for their learning task. This category includes the use of the Web and/or other media to access facts, information, and/or insights available through the use of technology. Additionally, 73 (19.6%) of the observations included observing students using an interactive or presentation tech tool to support the learning task. This category includes use of software that supports the transfer of information among students and between students and teachers. Students participating in experience-based learning, or using technology to engage in a tech-driven, immersion learning experience were observed 64 (17.2%) times. This category includes the use of technology to engage students in game-based software, intense interactive simulations, and virtual reality associated with classroom learning goals. Only 13 (3.5%) observations were made when students used technology to collaborate among others or to interact with and/or collaborate with others to accomplish their learning task. This category includes the use technology for all forms of synchronous (same time, usually verbal), communication and many forms of near-synchronous (intermittent or streamed, usually text chat) communication.

Research Question 4

What categories of technology use, as defined by the IPI-T, are most frequently coded when student cognitive engagement codes 5 and 6 are recorded? To answer this question descriptive statistics were used to organize the nominal data in a frequency distribution table. Results are shown in Table 15. According to Valentine (2012) IPI-T category 1 is associated with disengagement, categories 2, 3, and 4 are associated with lower-order, surface thinking and categories 5 and 6 are associated with higher-order, deeper thinking. Results show that 114 observations out of 372 higher-order, deeper thinking was recorded. The team observed and recorded codes at a higher level, a 5 or a 6, 18 out of 21 times when students were observed developing media, 11 out of 13 times collaborating among others, and 48 out of 64 times when they participated in experience-based technology. In contrast, 110 out of 372 observations were made of students using technology to search for information at a low level (2, 3, or 4).

Table 15. Tech Use Categories: Frequency of Student Cognitive Engagement Codes

	IPI-T Engagement Categories						
Tech Use Categories	Dis-engaged	L/O Teacher Not Engaged	L/O Teacher Engaged	Teacher-Led	H/O Students Verbal	H/O Students Not Verbal	Total
Word Processing	4	14	12	0	1	3	34
Math Computations	0	5	7	4	1	5	22
Media Development	0	1	2	0	6	12	21
Information Search	12	46	55	9	11	12	145
Collaboration Among Individuals	0	0	2	0	5	6	13
Experience-Based Technology	0	3	8	5	8	40	64
Interactive/ Presentation Technology	2	24	18	4	3	22	73
	18	93	104	22	35	100	372

Note. H/O Students Verbal = 5. H/O Students Not Verbal = 6.

Research Question 5

How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect the teacher's use of technology use in the classroom? To answer this qualitative question, participants responded to both closed and open-ended questions on a web-based questionnaire created using Google Forms. The closed-ended question was followed by an open-ended question. Question 1 was a closed-ended question and asked, *did you participate in all faculty collaborative study sessions?* Each of the eight participants (100%) responded "yes". Question 2 was also a closed-ended question and asked participants to rate the impact of faculty collaborative sessions on their own use of technology in their classroom. On a scale of strongly agree to strongly disagree, two participants chose "strongly agree" and six participants chose "agree". Two key themes emerged from participant responses (see Table 16) as a result of following up Question 2 with the open-ended Question 3, *please explain your response in more detail*.

Theme 1: Technology Integration

The Instructional Practice Inventory – Technology (IPI-T) is a walkthrough observation tool designed to collect data concerning how often and in what ways teachers are integrating technology as well as how often students are cognitively engaged in higher order, deeper thinking and can be used to help faculty align technology standards both at grade level and content areas. Faculty discussed the new ways in which they integrated technology as a result of participating in the Faculty Collaborative Study Sessions.

1. "During discussions there were some new ideas shared about Google Classroom that I have tried."
2. "Working together is essential for implementing higher-order thinking and engagement in the classroom."
3. "After the initial faculty session, I was much more aware of how I was utilizing technology and I was much more aware of the cognitive level I was asking students to work at."
4. "These sessions have helped me learn ways I can have my students use technology that I did not know before."

Theme 2: Implementing New Technology

Faculty shared experience associated with implementing new technology as a result of participating in Faculty Collaborative Study Sessions. These experiences included:

1. "I feel like I became more aware of available technology resources that I could use in my classroom".
2. "I am implementing more as time allows."
3. "Made you more aware of using technology instead of paper/pencil"
4. "When talking with coworkers, I was able to learn new apps to use in my classroom. I was able to ask specific questions and receive immediate response."

Table 16. Qualitative Question 3 on Web-Based Questionnaire

Q3. Please explain your response in more detail.	
Theme	Description
Technology Integration	Faculty shared experiences of integrating new technology.
Implementing New Technology	Faculty shared their experiences of implementing new technology such as Google Classroom and Desmos Calculators. In addition, faculty shared a new awareness of technologies available.

Note. Participants (n=8)

Research Question 6

How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect students' use of technology use in the classroom? To answer this qualitative question, participants responded to both closed and open-ended questions on a web-based questionnaire created using Google Forms. Each closed-ended question was followed by an open-ended question. Question 4 was a closed-ended question and asked participants to rate the impact of faculty collaborative sessions on students' use of technology in their classroom. On a scale of strongly agree to strongly disagree, four participants chose "strongly agree" and four participants chose "agree".

Two key themes emerged from participant responses (see Table 17) as a result of following up Question 4 with the open-ended Question 5, *please explain your response in more detail*.

Theme 1: Awareness

The IPI-T is designed to quantify how often students are cognitively engaged in higher order, deeper thinking. A total of twenty-seven faculty members participated in four Faculty Collaborative Study Sessions. One theme that arose from the eight participants that completed the questionnaire was a raised awareness of the necessity to increase student cognitive engagement and the need to integrate technology in a way that promoted higher order, deeper thinking. Participants shared:

1. "I was more aware of how I was asking them to use their technology and what processing skills they were using."
2. "I strive to self-monitor and reflect on my teaching to help my students reach the 5 and 6 higher-order thinking and engagement with the use of technology; therefore, I incorporated using Padlet as a way for students to reach the higher levels of engagement. I truly do take the time to self-reflect on how I can enhance the learning environment at a higher level."
3. "Being involved is a good thing, makes you take ownership of something and you are all on the same page."
4. "Made me aware of the student engagement going on throughout building."

Theme 2: More Time

The second theme that arose was the need for more time. More time to not only collect data but to continue to participate in faculty collaborative study sessions. Faculty expressed the need to continue the build longitudinal data in an effort track trends and patterns. In addition, responses indicated the need for time to be allotted so that faculty can participate in purposeful professional development opportunities that are designed to integration educational technology in and in a higher-order manner.

Table 17. Qualitative Question 5 on Web-Based Questionnaire

Q5. Please explain your response in more detail.

Theme	Description
Awareness of Tech Usage	Faculty shared a deeper awareness of the importance of integrating technology as a result of the Faculty Collaborative Study Sessions.
More Time	Faculty members admitted increasing student cognitive engagement was going to take time as well as continued participation in Faculty Collaborative Study Sessions.

Note. Participants (n=8)

Summary

The impact of implementing the Instructional Practices Inventory – Technology (IPI-T) process with fidelity was investigated in this mixed methods study. Data were collected through the IPI-T data collection tool for the quantitative portion, and of the 27 participants who participated in the faculty collaborative study sessions, eight participants responded to a web-based questionnaire for the qualitative portion. Analysis using a One-way ANOVA revealed that implementation of faculty collaborative sessions within one week of data collection had a significant impact on students' technology use and engagement. Descriptive statistics were used to create frequency tables in an effort to organize the data which revealed that students participate in information searches more frequently than other categories of technology and particular technology categories such as media development, collaboration among individuals, and experience-based learning using technology support higher-order, deeper thinking. Responses from the questionnaire were thematically analyzed and interpreted in an effort to further explain the quantitative findings. Key themes emerged from the thematic analysis: (a) technology integration, (b) implementing new technology, (c) awareness of tech use, and (d) more time. Results are further discussed in Chapter 5.

Citation

Wallace-Spurgin, M. (2019). Research findings. In I. Sahin & V. Akerson (Eds.), *Measuring student cognitive engagement when using technology* (pp. 51-64). Monument, CO, USA: ISTES Organization.

CHAPTER 5:

DISCUSSION OF RESEARCH FINDINGS AND CONCLUSIONS

The IPI-T data collection team coded 217 observations from January 2018 through April 2018 after increasing technology devices nearly one per student at the high school. Analysis of the data showed only 95 observations were coded in which students were the users of technology. The results of faculty participating in faculty collaborative study sessions within one week of data collection was the focus of this mixed methods study. Data were collected through the IPI-T data collection process for the quantitative portion, and a small group completed a web-based questionnaire for the qualitative portion. The purpose of this explanatory-sequential mixed method study was to assess the impact of the IPI-T process on technology use and student cognitive engagement. The impact was measured by comparing quantitative IPI-T data codes of those faculty that participated in faculty collaborative study sessions with baseline data prior to the implementation of the faculty collaborative study sessions. Data collected using the IPI-T process were examined, analyzed, and presented in Chapter 4. In Chapter 5, a summary of the findings, interpretations of the findings, implications for practice and theory, limitations, recommendations for future research, and a conclusion are provided.

Summary of Findings

An examination of the data revealed that participation in faculty collaborative study sessions had a statistically significant impact on student technology use as well as student cognitive engagement when using technology. While teacher technology use did increase, the expected impact of participating in faculty collaborative study sessions was that teachers' technology use would actually decrease. Descriptive statistics revealed more often students participate in information searches and word processing when they are the users of technology which are associated with lower-order/surface thinking. Furthermore, results showed that 31% of the codes collected, higher-order/deeper thinking was observed when students were the user of technology. Technology use categories observed at a higher level included media development, collaboration among individuals, and experience-based technology. For the qualitative portion, data were thematically analyzed and interpreted looking for overlapping themes within the open-ended questions, with the goal of providing a greater understanding of the quantitative results and the impact the faculty collaborative study sessions had on technology use and student cognitive engagement. Four key themes emerged: (a) technology integration, (b) implementing new technology, (c) awareness of tech usage, and (d) more time. Of the four themes that emerged from the questionnaire responses, the greatest overlap was regarding awareness. In line with the first order-external barriers discussed within the literature review, all eight of the participants mentioned that more time is necessary. Specifically, participants stated that they need more time to study and analyze the IPI-T data as well as to participate in purposeful professional development.

Interpretation of Results

This section summarizes and interprets the results of the quantitative portion of the study which utilized the IPI-T data collection tool as well as the qualitative portion, a web-based questionnaire.

Research Question 1

To what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)? This research question attempted to determine if participating in faculty collaborative sessions had an impact on teacher technology use, specifically if teacher use of technology would decrease. Research shows when teachers do use technology for instruction, they may not be using it to its fullest potential to promote high levels of student cognitive engagement (Cuban, Kirkpatrick, & Peck, 2001; Gurgenidze, 2018; Pambayun et al., 2019; Prensky, 2015; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Schrum & Levin 2012; Zhao, Pugh, Sheldon, & Byers, 2002). In line with recent studies (Cuban et al., 2001; Russell et al., 2003) despite large expenditures of Chromebooks, baseline data collected at the targeted high school indicated teachers were the users of technology, rather than students. According to baseline data collected using the IPI-T data collection tool, after 215 observations of 27 high school classrooms, 63 observations were made in which no technology was observed, 59 observations were coded as teachers using technology, and 95 observations were made in which students were the user of technology.

Missing from the process during the 2017-18 pilot of the IPI-T was the implementation of faculty collaboration sessions. Valentine (2012b) stated, "The greater the implementation integrity to these strategies, the greater the likelihood the school will see positive academic results from their use of the IPI" (p. 1). The sessions provided faculty with time to study the data after each data collection, engaged faculty in a reflection of the data, created collaborative learning experiences that built new knowledge, and allowed faculty voice in the establishment of annual cognitive engagement goals. The results of the quantitative data revealed, despite implementation of faculty collaborative study sessions, teacher technology use increased (Figure 4). While an increase of technology use seems in line with the found alternative hypothesis which stated: *participating in faculty collaborative study sessions does affect faculty's technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T),* results show teachers typically used technology in a lower-order/surface manner to assist in the delivery of instruction. Much of the time teachers were observed using their Interactive Whiteboards to project directions or notes as instruction was delivered in a lecture format. According to Valentine (2012), examples of teacher-led instruction includes classroom practices commonly associated with teacher dominated questions and answers, teacher lecture or verbal explanations, teacher direction giving, and teacher demonstrations. Discussions may occur, but instruction and ideas come primarily from the teacher. Student higher-order, deeper learning is not evident.

Research Question 2

To what extent does participation in faculty collaborative study sessions affect student's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)? This research question attempted to determine if participating in faculty collaborative sessions had an impact on students' technology use. Specifically, if student use of technology would increase as well as student cognitive engagement when using technology. Coding using the IPI-T data collection tool took place four times during the school year 2017-18 in an effort to gather baseline data. When observed using technology, students were engaged in lower-order surface thinking activities 70.4% of the time. Throughout the initial collection of baseline data, the researcher noticed technology use by the teacher decreased slightly, increasing student use of technology, but disengagement increased dramatically as did the integration of activities that fall within categories 4, 3, and 2 on the IPI-T (Table 13). Again this is not surprising as the researcher and the IPI-T data collection team did not implement the IPI-T process in its entirety, leaving out the faculty collaborative study sessions in the first year. Time was not provided to analyze the data or participate in purposeful professional development that prepared faculty to integrate technology.

The Barrier to Technology model, suggests there are two sets of barriers, external and internal, that influence the integration of technology in teachers' classrooms (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Sahin & Thompson, 2006; Soparat, Arnold& Klaysom, 2015). First order-external barriers are also known as resource barriers. Sufficient time allowance to prepare for technology-integrated instruction is an example of a resource barrier (Hew & Brush, 2007; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018). According to Valentine (2017), "When IPI/IPI-T data are collected for the purposes of school improvement, all teachers should have the opportunity to study the data and reflect upon their perceptions of effective learning/instructions" (p. 3). Faculty should converse about best practices and the value of the six categories. Once a baseline is established, discussions about how to change the engagement profiles over time should occur to ensure instructional design and teaching practices evolve. Upon collecting data using the IPI-T, a faculty collaborative study session occurred. Faculty was arranged in small table groups to encourage collaborative learning in an effort to build new knowledge. Participants were engaged in both a reflection about the data collection day and a comparison of the data. In addition, examples of higher-order and lower-order activities were presented and faculty had the opportunity to work collaboratively to design the ideal lesson that integrated both technology and higher-order, deeper thinking. Lastly, during the last study session, faculty worked together and established cognitive engagement goals for the upcoming 2019-2020 school year which support higher-order, deeper thinking skills among students. Throughout the process the researcher made a conscious effort to continuously understand faculty perspectives and progress accordingly (see Appendices D, E, F, and G).

The first data collection profile served as baseline data and subsequent data collections provided longitudinal perspectives of engaged learning for the school. Teacher leaders collected the data. The researcher engaged faculty in studying the data to identify patterns, trends, and changes in each data profile. In addition, she established and delivered purposeful professional development and continuous conversations. Valentine (2017) stated, "To make a difference in student cognitive engagement, the faculty IPI/IPI-T collaborative conversations must progress from merely studying profile percentages to learning discussions that deepen knowledge, build a commitment to refinement of instructional practices, particularly increasing higher-order/deeper thinking time and reducing disengagement during class time" (p. 3). The results of quantitative data analysis of this study, indicated that participation in faculty collaborative study sessions had an effect on students' technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T). A One-way ANOVA revealed a significant difference among the baseline, first, second, third, and fourth faculty collaborative sessions, p = .02 (Table 15). In addition, when observed using technology, higher-order, deeper cognitive engagement among students increased, lower-order, surface cognitive engagement decreased, and student disengagement decreased (Table 13).

Research Question 3

What categories of technology use, as defined by the IPI-T, are most frequently used in 9-12 classrooms within the targeted district? This research question attempted to identify the categories of technology use most frequently used in the 9-12 classrooms that were observed. Data was collected using the IPI-T observational tool four times, including the collection of baseline data. Results of the quantitative analysis of data revealed a total of 372 observations were made in which students were using technology (Table 16). Of the 372 observations, students were observed searching for information more frequently than other categories of technology use. According to Valentine (2015), when students are involved in information searches they are using technology to search and/or gather information for their learning task. This category includes the use of the Web and/or other media to access facts, information, and/or insights available through the use of technology. The second most frequently observed category of technology use was students using an interactive or presentation tech tool to support the learning task. This category includes use of software that supports the transfer of information among students and between students and teachers. The third most frequently observed category of technology use was experience-based immersion learning, or using technology to engage in a tech-driven, immersion learning experience. This category includes the use of technology to engage students in game-based software, intense interactive simulations, and virtual reality associated with classroom learning goals. Very few observations were made when students used technology to collaborate among others or to interact with and/or collaborate with others to accomplish their learning task. This category includes the use technology for all forms of synchronous (same time, usually verbal), communication and many forms of near-synchronous (intermittent or streamed, usually text chat) communication (Figure 5). Valentine (2012c) has collected tens of thousands of codes, educating more than 23,000 educators in the IPI-T data collection process. Results of this study align with Valentine's findings. According to Valentine (2018), experience-based immersion learning and collaboration among individuals are two categories of technology use that are least frequently observed but are most commonly associated with higher-order, deeper thinking. Likewise, information searches are observed most frequently and associated with lower-order, surface thinking.

Research Question 4

What categories of technology use, as defined by the IPI-T, are most frequently coded when student cognitive engagement codes 5 and 6 are recorded? This research question attempted to identify the categories of technology use when Student Cognitive Engagement Codes 5 and 6 were recorded. The IPI-T data collection process was piloted and field tested in 2011-12. The IPI-T is an 'add-on' component designed for schools that have experience with the IPI process and are currently 1:1 (one technology device per student) or planning to soon become 1:1 or high-tech schools. There are six categories associated with student cognitive engagement and eight tech-use categories measured by the IPI-T.

According to Valentine (2012) IPI-T Student Cognitive Engagement Category 1 is associated with disengagement, Categories 2, 3, and 4 are associated with lower-order, surface thinking and Categories 5 and 6 are associated with higher-order, deeper thinking. Tech-use categories include:

1.Word Processing. The students are using technology to produce written documents. This category includes note taking, composing papers, editing, formatting, and printing the written material.

2.Math Computations. The students are using technology to perform mathematical computations. This category includes calculating, charting, and plotting with hand-held calculators, spreadsheets, and statistical formulae.

3.Media Development. The students are using technology to collect, manipulate, and/or create media. This category includes the use of technology to collect, edit, and/or design photo, video, and/or audio data and presentations, as well as programming, writing code, and web development.

4.Information Search. The students are using technology to search and/or gather information for their learning task. This category includes the use of the Web and/or other media to access facts, information, and/or insights available through the use of technology.

5.Collaboration Among Individuals. The students are using technology to interact with and/or collaborate with others to accomplish their learning task. This category includes the use technology for all forms of synchronous (same time, usually verbal), communication and many forms of near-synchronous (intermittent or streamed, usually text chat) communication.

6.Experience-Based Immersion Learning. The students are using technology toengage in a tech-driven, immersion learning experience. This category includes the use of technology to engage students in game-based software, intense interactive simulations, and virtual reality associated with classroom learning goals.

7.Interactive/Presentation Technology. The students and/or teacher are using an interactive or presentation tech tool to support the learning task. This category includes us of software that supports the transfer of information among students and between students and teachers.

8.Other. Occasionally the data collector may determine that none of the seven options adequately describe how students are using technology. This "other" option should be marked if that is the case. However, selection of this "other" option is extremely unusual.

According to Valentine media development is the most likely tech-use category to produce higher-order, deeper thinking at the high school level. Experience-based immersive learning is also highly likely to produce higher-order, deeper thinking at the high school level. Math computations is most commonly used for student skill and drill practice and in high schools, the most common form of collaboration via technology is misuse of the technology for email, blogs, and social media, coded a "1" for disengagement. Information search in high schools is primarily fact finding without higher-order analysis. Valentine (2018) stated with caution, "the volume of data at this time is large enough to provide interesting insights and probable trends, but too small to make firm conclusions about the relationships" (slide 82). Results of this study show that less than half of the total observations, in which students were the users of technology, higher-order, deeper thinking was recorded. However, tech use categories recorded at a higher level, a 5 or a 6, include: Media Development, Experience-Based Immersion Learning, and Collaboration Among Individuals. In contrast, the tech use category most often observed was Information Search. When students used technology to search for information an engagement code was recorded at a low level (2, 3, or 4).

Research Question 5

How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect the teacher's use of technology use in the classroom? This research question attempted to determine if faculty viewed their participation in faculty collaborative study sessions as having an impact on their technology use in the classroom. The Instructional Practice Inventory – Technology (IPI-T) is a walkthrough observation tool designed to collect data concerning how often and in what ways teachers are integrating technology as well as how often students are cognitively engaged in higher-order, deeper thinking and can be used to help faculty align technology standards both at grade level and content areas. The baseline data collected during the 2017-18 school year indicated teachers were the user of the technology most of the time, in line with claims that indicate while access to technology in most cases is no longer the major issue (Davis, Preston, & Sahin, 2009; Hilton & Canciello, 2018; Schrum & Levin, 2015; Zhao et al., 2002); computer usage in the classroom among students remains low (Cuban, 1999; Wang, Hsu, Campbell, Coster, Longhurst, 2014; Walters, Green, Goldsby, & Parker, 2018; Zhao et al., 2002). While it was the intend of the faculty collaborative sessions to in fact decrease the use of teacher technology and increase student use, teacher technology use increased.

At the end of the final faculty collaborative study session eight participants were asked to complete a web-based questionnaire. The questionnaire was comprised of closed-ended questions, followed by an open-ended question. Even though teacher technology use increased and much of the time was used to support teacher-led instruction, themes emerged from each open-ended response that supports the integration and implementation of educational technology.

*Theme 1: Technology Integration***.** It is evident from responses that participants recognize and believe that participation in the faculty collaborative study sessions affected or impacted technology integration in their classroom. For example, faculty discussed the new ways in which they integrated technology as a result of participating in the Faculty Collaborative Study Sessions. Participants shared the following, “Working together is essential for implementing higher-order thinking and engagement in the classroom.” Also, “After the initial faculty session, I was much more aware of how I was utilizing technology and I was much more aware of the cognitive level I was asking students to work at.”

Theme 2: Implementing New Technology. In addition, as a result of participating, faculty shared experiences associated with implementing new technology. Faculty members stated, “I feel like I became more aware of available technology resources that I could use in my classroom.” Faculty felt supported by each other and stated, “When talking with coworkers, I was able to learn new apps to use in my classroom. I was able to ask specific questions and receive immediate response”.

It seems the eight participants that completed the questionnaire may have not truly understood the question or may have not interpreted the question correctly. The question read, “How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect the teacher’s use of technology use in the classroom?” When given the opportunity to explain their response one participant stated, “These sessions have helped me learn ways I can have my students use technology that I did not know before.” An explanation could be that faculty spent the majority of time analyzing student cognitive engagement when working collaboratively during each session, rather than focusing the deliberate attempt to decrease their own technology use.

Research Question 6

How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect students' use of technology use in the classroom? This research question attempted to determine if faculty viewed their participation in faculty collaborative study sessions as having an impact on their students' technology use in the classroom. The small group of participants that responded to the questionnaire share the belief that participation in faculty collaborative student sessions impacted or affected their students' technology use in the classroom. The IPI-T is designed to quantify how often students are cognitively engaged in higher order, deeper thinking while the qualitative portion of this study attempted to seek feedback from the faculty to gain an understanding of their viewpoint. Their responses support the quantitative portion of this study. Two themes arose from their responses to the questionnaire.

Theme 1: Awareness. The first theme was a raised awareness of the necessity to increase student cognitive engagement and the need to integrate technology in a way that promoted higher order, deeper thinking. One participant stated, "I strive to self-monitor and reflect on my teaching to help my students reach the 5 and 6 higher-order thinking and engagement with the use of technology; therefore, I incorporated using Padlet as a way for students to reach the higher levels of engagement. I truly do take the time to self-reflect on how I can enhance the learning environment at a higher level."

Theme 2: More Time. The second theme was the necessity to dedicate more time to study data and participate in purposeful professional development. Valentine (2017) recommends each school collect data four times each school year to achieve optimum impact. Teacher leaders collecting the data should engage faculty in studying the data to identify patterns, trends, and changes in each data profile as well as establish and deliver purposeful professional development and continuous conversations. Valentine (2017) stated, "To make a difference in student cognitive engagement, the faculty IPI/IPI-T collaborative conversations must progress from merely studying profile percentages to learning discussions that deepen knowledge, build a commitment to refinement of instructional practices, particularly increasing higher-order/deeper thinking time and reducing disengagement during class time" (p. 3). After studying baseline data and three other data profiles twenty-seven faculty studied trends and changes. In addition, they participated in continuous conversations about technology and integration to promote an increase in higher order, deeper thinking among students. The eight participants each shared that more time to study data and participate in purposeful professional development was necessary. This is an indication that they would be in support of continuing data collection using the IPI-T as well as participating in collaborative sessions. In addition, it is the role of the researcher to provide meaningful professional development opportunities that support the inclusion of educational technology. Based on responses faculty are more willing to participate than in the past.

Research Question 7

How does the qualitative follow-up data help us to better understand the quantitative first-phase results? Research Questions 1and 2 are quantitative and ask:

1.To what extent does participation in faculty collaborative study sessions affect faculty's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)? The null hypothesis stated that participating in faculty collaborative study sessions has no effect on faculty's technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T).

2.To what extent does participation in faculty collaborative study sessions affect student's technology use as measured by codes on the Instructional Practices Inventory-Technology (IPI-T)? The null hypothesis stated that participating in faculty collaborative study sessions has no effect on students' technology use as measured by codes on the Instructional Practices Inventory – Technology (IPI-T).

The null hypothesis for Research Question 1 was rejected. Faculty were led in a collaborative discussion about the difference between Cognitive Engagement Codes 6, 5, 4, 3, 2, and 1. Each session a minimum of five minutes was spent reviewing what each category meant, along with classroom examples such as student participating in simple recall or listening to a teacher stand at the front of the row and lead instruction (see Appendices D-G). To understand the results, the researcher included the following qualitative question in the questionnaire: "How do faculty view their participation in faculty collaborative study sessions? Specifically, did participating affect the teacher's use of technology use in the classroom? Despite the collaborative discussions, teacher use of technology increased. It could be said that participation in faculty collaborative study sessions affected teacher use of technology, just not in terms of frequency, but rather how technology was used. Unfortunately, an IPI-T Category of Tech Use is only recorded when students are using technology so the researcher was not able to record if teachers changed the way they were using technology themselves. Participant responses indicated they may have misinterpreted the question and focused on student use rather than their own use of technology.

Similarly, the null hypothesis for Research Question 2 was rejected. The qualitative phase of this mixed method study not only supported the findings of the quantitative phase but gave way to an understanding of how faculty value their efforts to engage in an analysis of the IPI-T data as well as the trends and patterns they have identified when meeting in small groups during collaborative sessions (see Appendices D-G). Key themes that emerged from the qualitative questions include and awareness of the need to integrate technology but also an awareness of the need to implement technology that encourages higher-order, deeper thinking among students. Additionally, faculty seem to be "breaking down" some of the barriers that have existed when considering the implementation of technology. For example, while time is a factor, there has been an acceptance that time is necessary for growth in the area of technology integration. Faculty believe they should continue to gather IPI-T data into the next school year and study it collaboratively with the intent to continue to establish goals of technology integration. In addition, faculty have gained a willingness to spend time participating in purposeful professional development that supports a change in the way students use technology.

Implications of Findings

This mixed method study provides empirical evidence that implementing the IPI-T data collection process in its entirety impacts technology use among faculty and students. Student technology use increased, as did cognitive engagement. However, evidence indicates that most of the time students are asked to search for information, a low-level skill. Less often students were observed creating media, collaborating using technology, or participating in experience-based learning, all associated with higher-order, deeper thinking.

As the most technologically literate group of children enter the classroom, it is necessary to participate in continuous collaborative conversations and to look at current educational practices. Educators should consider "the skills, competencies, values needed on the future global age, and how generation alpha should be prepared, scholastically" (Culala, 2016). Zhao et al. (2002) claimed that changing current educational practices regarding the use and integration of technology is complex and messy. This study supports that claim. While complex, over time the 27 participants that participated in collaborative conversations progressed from merely studying profile percentages to learning discussions that deepened their knowledge. They came to value the integration of technology and built a commitment to the refinement of instructional practices that increased higher-order, deeper thinking time and reduced disengagement among students when using technology.

The Barrier to Technology model, suggests there are two sets of barriers, external and internal, that influence the integration of technology in teachers' classrooms (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). First order-external barriers are also known as resource barriers. Sufficient time allowance to prepare for technology-integrated instruction is an example of a resource barrier (Hew & Brush, 2007; Kopcha, 2012; Vongkulluksn, Xie, & Bowman, 2018). In addition, Vongkulluksn et al. (2018) considered the second order-internal barriers, teachers' value beliefs as the "most proximal determinant of technology integration" regarding them most important to using technology for learning (Ertmer, 1999; Ertmer and Ottenbreit-Leftwich, 2010; Ertmer et al., 2012).This study indicates that engaging faculty in a series of collaborative study sessions of the IPI-T data has been shown to have the capacity to remove barriers to technology use by teachers to fulfill instructional goals, increase teachers' ability beliefs, increase student usage of technology, and positively impact student cognitive engagement and academic success.

There is no prescribed training or professional development to date that guarantees an increase in technology use as well as an increase in higher-order, deeper thinking among students. According to Denessen (2000), pedagogical beliefs refer to the understandings about teaching and learning that teachers hold to be true (as cited in Tondeur et al., 2016). Described by Pajares (1992), a teacher's belief system includes beliefs about their roles and responsibilities, the subject matter taught, as well as beliefs about their students (as cited in Tondeur et al., 2016). Complex and multifaceted pedagogical beliefs include core beliefs, those that are most stable and the most difficult to change as they have connections to other beliefs versus beliefs that are peripheral and formed recently are more open to change

(Tondeur et al., 2016). Deng, Chai, Tsai, and Lee, (2014) along with Inan and Lowther, (2010) maintained that personal pedagogical beliefs of teachers "play a key role in their pedagogical decisions" to integrate technology within their classroom practices (as cited in Tondeur et al., 2016). Within the field of education technology teachers' beliefs have been classified into one of two categories: teacher-centered and student centered beliefs. Educational technology best practices are those that promote student-centered learning (Ottenbriet-Leftwich, Glazewski, Newby, and Ertmer, 2010; Tondeur et al, 2016). A clear implication of this study is the need for professional development for both practicing and preservice teachers. The goal should be to create a series of trainings or professional development opportunities that are student-centered and promote the integration of technology as well as a strong knowledge of curriculum activities. The activities should emphasis or promote higher-order, deeper thinking, such as those activities found in Bloom's Digital Taxonomy.

Limitations of the Study

The researcher chose to employ a quasi-experimental within-subjects approach utilizing a pretest and posttest design. One group participated in this study. A convenience sampling strategy was employed for the quantitative strand of the study because participants were willing and available to participate. The sample of teachers chosen from the population of teachers in the district was relatively small. Participants from the small subgroup had the potential to provide useful information for answering questions and hypotheses, however, it is difficult for the researcher to say with confidence that the individuals represented the entire teacher population. Additional disadvantages to this approach were threats to internal validity which include maturation and history because the study took place over the course of several months. Further, an assumption is observations represented typical school days, and that teachers did not alter instruction when the IPI-T data collection team was present. While the possibility of observer bias exists, training was provided to all teacher leaders who collected codes in an effort to standardize data collection. It is important to know that the process for developing the data collector's validity, reliability, and inter-rater reliability during was the central focus during both IPI Level I Basic Workshop and the IPI-T Component Workshop. Upon the conclusion of each IPI-T workshop participants were required to complete a Reliability Assessment and a reliability score of .90 or higher was necessary for permission to use the IPI-T Process for research purposes. The researcher earned a reliability score of .95 on the IPI assessment and .98 on the IPI-T assessment.

Recommendations for Future Research

This mixed methods study contributes to the overall understanding of the capacity of removing barriers to technology use when faculty engage collaboratively in the analysis of data and instructional practices on a regular basis to fulfill instructional goals, increase student usage of technology, and positively impact student cognitive engagement and academic success. Future research should extend these findings by replicating this study with faculty from the same school district in different grade levels or with the same faculty, grades 9-12, to gather longitudinal data. Findings from future research, examining the impact of participating in faculty collaborative study sessions at multiple grade levels, could be used to inform district initiatives, school improvement, and the development of professional development to integrate technology. The IPI and IPI-T encourages faculty members to work towards a balance of higher and lower levels of student cognitive engagement through incremental changes in instructional practice (Dennis, 2013). Gathering longitudinal data could be used to inform change in instructional practices over time. Additionally, future studies should include an examination of the change in technology instructional practices when faculty participate in faculty collaborative study sessions over a period of time.

In an effort to increase student use of technology and align current teaching practices with the integration of technology, the IPI-T process assisted in the collection of data to get an insight into how students were cognitively engaged in the learning during the instructional activity. Implementing the IPI-T process in its entirety encouraged faculty members to study the data and think collaboratively about ways to work towards a balance of higher and lower levels of student cognitive engagement through incremental changes in instructional practice (Dennis, 2013). Categories 6 and 5 include learning activities that fall within the higher-order/deeper thinking spectrum of Bloom’s Taxonomy and Bloom’s Digital Taxonomy such as media development, collaboration among others, and experience or problem based learning. This study identified a relationship between specific technology-use categories and specific IPI-T student cognitive engagement codes. Studies should be done to identify engaging activities designed for specific technology-use categories that promote higher-order thinking.

Summary and Conclusions

The purpose of this explanatory-sequential mixed method study was to assess the impact of the IPI-T process on technology use and student cognitive engagement. The goal was to implement all strategies, including faculty collaborative sessions four times per year to support teacher implementation of new technology to increase higher-order, deeper thinking by students and increase student use of technology. The impact was measured by comparing quantitative IPI-T data codes of those faculty that participated in the intervention group with baseline data prior to the implementation of the faculty collaborative study sessions. Data collected during the quantitative phase was the emphasis of this study. Qualitative data was gathered from one participant from each core and non-core area, a total of eight participants. Each were asked to answer questions on a web-based questionnaire during the final faculty collaborative session. Four key themes emerged and each was associated with the quantitative portion of the study.

Findings from this mixed methods study confirm that implementing the IPI-T process in its entirety increases both technology use and student cognitive engagement. The IPI-T process was created in 2012 by Valentine and a team of specialists. The IPI-T is an 'add-on' component designed for schools that have experience with the IPI process and are currently 1:1 (one technology device per student) or planning to soon become 1:1 or high-tech schools. Implementing the entire IPI-T process with fidelity has been shown to have a positive influence on student technology use and student cognitive engagement. School board members in the targeted district have already purchased $250,000 worth of Chromebooks and have committed to additional purchases in the upcoming school year. As they move toward a 1:1 environment, longitudinal data can be studied and the IPI-T process can drive collaborative discussions among teachers and leaders to ensure a successful adoption of technology.

Citation

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APPENDIXES

Appendix A. Instructional Practices Inventory Categories

Instructional Practices Inventory Categories

Student Active Engaged Learning (6)	Students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking, creativity, and/or synthesis. Engagement in learning is not driven by verbal interaction with peers, even in a group setting. Examples of classroom practices commonly associated with higher-order/deeper Active Engaged Learning include: inquiry-based approaches such as project-based and problem-based learning; research and discovery/exploratory learning; authentic demonstrations; independent metacognition, reflective journaling, and self-assessment; and, higher-order responses to higher-order questions.	**Student Engagement in Higher-Order Deeper Learning**
Student Verbal Learning Conversations (5)	Students are engaged in higher-order thinking and developing deeper understanding through analysis, problem solving, critical thinking, creativity, and/or synthesis. The higher-order/deeper thinking is driven by peer verbal interaction. Examples of classroom practices commonly associated with higher-order/deeper Verbal Learning Conversations include: collaborative or cooperative learning; peer tutoring, debate, and questioning; partner research and discovery/exploratory learning; Socratic learning; and, small group or whole class analysis and problem solving, metacognition, reflective journaling, and self-assessment. Conversations may be teacher stimulated but are not teacher dominated.	
Teacher-Led Instruction (4)	Students are attentive to teacher-led instruction as the teacher leads the learning experience by disseminating the appropriate content knowledge and/or directions for learning. The teacher provides basic content explanations, tells or explains new information or skills, and verbally directs the learning. Examples of classroom practices commonly associated with Teacher-Led Instruction include: teacher dominated question/answer; teacher lecture or verbal explanations; teacher direction giving; and, teacher demonstrations. Discussions may occur, but instruction and ideas come primarily from the teacher. Student higher order/deeper learning is not evident.	**Student Engagement in Knowledge and Skill Development**
Student Work with Teacher Engaged (3)	Students are engaged in independent or group work designed to build basic understanding, new knowledge, and/or pertinent skills. Examples of classroom practices commonly associated with Student Work with Teacher Engaged include: basic fact finding; building skill or understanding through practice, "seatwork," worksheets, chapter review questions; and multi-media with teacher viewing media with students. The teacher is attentive to, engaged with, or supportive of the students. Student higher-order/deeper learning is not evident.	
Student Work with Teacher not Engaged (2)	This category is the same as Category 3 except the teacher is not attentive to, engaged with, or supportive of the students. The teacher may be out of the room, working at the computer, grading papers, or in some form engaged in work not directly associated with the students' learning. Student higher-order/deeper learning is not evident.	
Student Disengagement (1)	Students are not engaged in learning directly related to the curriculum.	**Students Not Engaged**

Remember: IPI coding is not based on the type of activity in which the student is engaged, but rather how the student is engaging cognitively in the activity. Examples provided above are only examples often associated with that category. The Instructional Practices Inventory categories were developed by Bryan Painter and Jerry Valentine in 1996. Valentine refined the descriptions of the categories (2002, 2005, 2007, and 2010) in an effort to more effectively communicate their meaning.
The IPI was developed to profile school-wide student engaged learning and was not designed for, nor should it be used for, personnel evaluation.

Jerry Valentine January 12, 2012

Appendix B. IPI-T Tech-Use Category Definitions and Examples

IPI-T TECH-USE CATEGORY DEFINITIONS AND EXAMPLES

1. **Word Processing.** ***The students are using technology <u>to produce written documents</u>.*** *This category includes note taking, composing papers, editing, formatting, and printing the written material.*

   Typical educational examples include using any form of technology to: (a) take in-class notes of teacher explanations, (b) composing, editing, formatting and printing documents and assignments, (c) summarizing and note taking while doing online research, (c) typing answers for assignments and tests, (d) corresponding via typed communications such as blogging and emailing. Examples of software commonly associated with this category are Microsoft Word, Google Docs, Mac Pages, Quick Office, Documents To Go.

2. **Math Computations.** ***The students are using technology <u>to perform mathematical computations</u>.*** *This category includes calculating, charting, and plotting with hand-held calculators, spreadsheets, and statistical formulae.*

   Typical educational examples include using any form of technology to: (a) compute mathematical calculations during math and science tasks, (b) practice math calculations to embed basic math facts and build computational skill, (c) conduct statistical analyses for research activities/projects, (d) create charts, graphs, and plots for research and reports. Examples of software commonly associated with this category are spreadsheets, web-based charts and graphing programs, math-education software designed to build and embed math skills by requiring the user to make necessary calculations by using the technology vs. doing paper/pencil calculations.

3. **Media Development.** ***The students are using technology <u>to collect, manipulate, and/or create media</u>.*** *This category includes the use of technology to collect, edit, and/or design photo, video, and/or audio data and presentations as well as programming, writing code, and web development.*

   Typical educational examples include: (a) making original, or locating and using existing, forms of media such as photos, video, and/or sound to produce a product, (b) compiling/editing the medium to design/produce a media product, (c) using packaged software and/or writing code to design/produce websites and web-based products. Examples of software commonly associated with this category are video and audio recording programs, editing software such as Photoshop, Audacity, MovieMaker, iMovie, presentation tools such as Prezi, PowerPoint, Glogster and SlideShare.

4. **Information Search.** ***The students are using technology <u>to search and/or gather information</u> for their learning task.*** *This category includes the use of the Web and/or other media to access facts, information, and/or insights available through the use of technology.*

   Typical educational examples include: (a) searching for simple facts or complex information via web-based search engines, (b) searching for information on e-books, e-textbooks, and similar documents provided via servers or loaded directly on student laptops/tablets. Examples of software commonly associated with this category are search engines such as Google, Bing, Yahoo, Ask, and browsers such as Explorer, Chrome, Firefox, Safari.

5. **Collaboration among Individuals.** ***The students are using technology to <u>interact with and/or collaborate with others</u> to accomplish their learning task.*** *This category includes the use of technology for all forms of synchronous (same time, usually verbal, communication) and many forms of near-synchronous collaboration (intermittent or streamed, usually text chat, communication).*

   Typical educational examples include: (a) written and/or verbal collaboration to accomplish learning tasks using technology that supports voice and/or visual discussions, instant messaging, social networking, cloud computing, blogging, e-mailing, texting. Examples of software typically associated with this category are Skype, Google Hangout, Google Docs, Moodle, Sharepoint, BlogSpot, Twitter, Pinterest.

6. **Experience-Based Technology.** ***The students are using technology to engage in a <u>tech-driven, immersion learning task.</u>*** *This category includes the use of technology to engage students in game-based software, intense interactive simulations, and virtual reality associated with classroom learning goals.*

   Typical educational examples include: (a) game software that requires depth of thought and investment of time to solve real-world problems, (b) simulations that require students to develop a rich, deep knowledge base to role play, (e.g. a historical character) individuals and/or events of past, present, and future. Examples of software typically associated with this category are *The Oregon Trail* and *Where in the World is Carmen Sandiego*, (original standards) and more contemporary programs such as *Flight to Freedom*, *The Boston Massacre of 1770*, Explorelearning Gizmos, *Build an Atom*.

7. **Interactive/Presentation Technology.** ***The students and/or teacher are using an <u>interactive or presentation tech tool to support the learning task</u>.*** *This category includes use of software that supports the transfer of information among students and between students and teachers.*

   Typical educational examples associated with the interactive segment include: (a) hand-held or computer-based question-answer software that scores and/or compiles responses, (b) software that supports the transfer of information between students and teachers such as an interactive website developed by the teacher to accept or disseminate information to/from students, and (c) prescriptive/programmed learning software which allows students to interact with information provided by the programmer in a (non-immersive) gaming or simulation format. Typical educational examples associated with the presentation segment of this category include: (a) computer-based large-screen interactive software/hardware, (b) multimedia tapes, disks, and other forms of analog and digital sound, video, or multimedia used to disseminate information to students, and (c) multi-media presentation tools used by students and/or teachers to document and/or share information. Examples of software include PowerPoint, Prezi, SlideShare, and Animoto. Examples of hardware/software combination tools include Smart Boards, Promethean Boards, Mimeo Boards,Hand-held "electronic clickers" and web-based response systems such as "Socrative" that can be used in class software for handhelds, cell phones, tablets, and laptops are also examples of strategies to engage students in this tech-use category. Prescriptive and programmed non-immersion learning software that engage students in skill building, practice, and/or assessments are other examples of student engagement common to this category.

Appendix C. IPI/IPI-T Data Recording Form (4-28-14)

IPI/IPI-T Data Recording Form (4-28-14)

School Name: ____________________ Obs. Date: ____________ Observer:____________________ Page Number: ______

Obs#	Grade	Period	Content	All Students		IPI Category Code for All Students						Tech Students		IPI-Tech Category Code for Tech Users						Technology			Core/ Non-Core
Obs#	1=1st 2=2nd 3=3rd 4=4th 5=5th 6=6th 7=7th 8=8th 9=PK 10=K	1=1st 2=2nd 3=3rd 4=4th 5=5th 6=6th 7=7th 8=8th	1=M 2=Sci 3=SS 4=ELA 5=F&P Arts 6=PE/H 7=VTC 8=SpEd 9=OtherA 10=OtherB	# of ALL Stu	# of ALL Stu NOT Eng	IPI ALL Stu 1	IPI ALL Stu 2	IPI ALL Stu 3	IPI ALL Stu 4	IPI ALL Stu 5	IPI ALL Stu 6	# of Tech Stu	# of Tech Stu NOT Eng	IPI-T Tech Stu 1	IPI-T Tech Stu 2	IPI-T Tech Stu 3	IPI-T Tech Stu 4	IPI-T Tech Stu 5	IPI-T Tech Stu 6	Tech-Use: 1=WP 2=MC 3=MD 4=IS 5=Call 6=Exp 7=P	User of Tech: 1=Stu 2=Tch	Tech Devel: 1=Con Ed 2=Tch 3=Stu 4=Con Not Ed	1=C 2=NC
Obs#	Grade	Period	Content	All Students		IPI Category for All Students in Class Circle Appropriate IPI Category						Tech Students		IPI-T Category for Tech Users Circle Appropriate IPI-T Category						Technology			C/NC
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				
						1	2	3	4	5	6			1	2	3	4	5	6				

*See Reverse Side for more detailed explanations of IPI and Tech-Use Categories and Data Recording Codes

IPI/IPI-T Data Recording Form 4-28-14

Appendix D. Faculty Collaborative Session 1

Approximate Time (minutes)	Activity/Task	Materials/Handouts
10-15	• Whole faculty explanation/discussion of the IPI Categories	• IPI Rubric
10-15	• Whole faculty explanation/discussion of the IPI data collection protocols	• IPI Protocol Summary
20-25	• Small group discussions of the School's IPI Profiles • Remember to always ask the group to talk openly about how "typical" were the learning experiences for the students during the IPI observation period.	• IPI Core Profile Chart • IPI Non-Core Profile Chart • IPI Total Profile Chart • IPI Faculty Data Analysis and Discussion Worksheet
15	• Small group report/share out of their analyses	• Chart paper
5-10	• Q and A Discussion	
5	• Closing Comments • Recommended Reading	• The IPI: A Process for Profiling Student Engaged Learning for School Improvement

Appendix E. Faculty Collaborative Session 2

Approximate Time (minutes)	IPI Faculty Work Session 2 Activities/Tasks	Materials/Handouts
5	• Whole faculty—review of the IPI Categories	• IPI Rubric • IPI Categories and Common Look-Fors
5	• Whole faculty—review of the IPI data collection protocols.	• IPI Protocol Summary
15	• Small group discussions comparing the first two sets of IPI Profiles • Remember to always ask the group to talk openly about how "typical" were the learning experiences for the students during the IPI observation period.	• Share with all staff: • IPI Core, Non-Core, and Total Profile Charts from both first and second observations • IPI Faculty Data Analysis and Discussion Worksheet
10	• Small group report/share out of their analyses	• Chart paper
10	• In each small group, identify two high-quality examples of learning experiences that foster student engaged learning that would be coded as a category 5 or 6 (higher-order learning).	• Categories 5-6 High-Quality Learning Experiences Worksheet
10	• In each small group, identify two high-quality examples of learning experiences that foster student engaged learning that would be coded as a category 2 or 3 (independent student work that fosters understanding of facts that is not at higher order thinking…i.e. good examples of worksheets and seatwork for students).	• Categories 2-3 High-Quality Learning Experiences Worksheet
5-10	• As time permits, ask some tables to share particularly good examples. Remember to write examples on pads or type them for projection, or in some way reinforce the examples to keep building the importance of thinking about "high-quality" learning experiences as contrasted to lesser-quality experiences that offer convenience or ease of design and implementation for the teacher. Take the opportunity to set high expectations for everyone with this discussion.	
5	• Q and A	
5	• Closing Comments	

Appendix F. Faculty Collaborative Session 3

Approximate Time (minutes)	IPI Faculty Work Session 3 Activities/Tasks (Or, Divide this into Two Work Sessions of about 60 minutes each)	Materials/Handouts
5	• Whole faculty—review of the IPI Categories	• IPI Rubric or PowerPoint • IPI Categories and Common Look-Fors or PowerPoint
5	• Whole faculty—review of the IPI data collection protocols.	• IPI Protocol Summary or PowerPoint
10-15	• Whole group orientation/overview of the bar and line graphs showing the longitudinal data for three (or more) IPI profiles.	• Excel spreadsheet IPI longitudinal profiles spreadsheet with bar and line graphs
20-30	• Small group discussions of the graphs with notetaking and "share outs"	• Graph copies for participants
30	• Small group discussion, identification, and prioritization of IPI objectives to establish for the school.	• IPI Objectives Worksheets
5	• Q and A	
5	• Closing Comments	

Appendix G. Faculty Collaborative Session 4

Faculty Goal-Setting Worksheet for Student Cognitive Engagement

Directions:

- In columns two, three, four, and five, you will see our school's IPI data for the past year.
- In column six, for each row determine whether our school's objective for this year should be: to maintain, increase, or decrease .
- In column seven write a brief statement indicating the amount of desired increase or decrease.
- In column eight write an approximate date by which your group believes the increase/decrease should be achieved.
- In the last column, prioritize the rows base upon the objectives that will make the most difference on student academic success by selecting High Priority, Moderate Priority, or Low Priority for that objective.
- After our discussion, our IPI Team will collect these sheets, summarize your collective input, and identify a goal or two for our IPI Work for next school year.

1	2	3	4	5	6	7	8	9
IPI Categories	**IPI Profile (Date Here)**	**IPI Profile (Date Here)**	**IPI Profile (Date Here)**	**IPI Profile (Date Here)**	**Select the word that best describes your objective.**	**If you selected increase or decrease, describe the desired percentage of change e.g. 22% to 30%.**	**Indicate the date by which your school should accomplish the desired change?**	**Prioritize the rows as High Moderate or Low**
6					Maintain Increase Decrease			High Moderate Low
5					Maintain Increase Decrease			High Moderate Low
4					Maintain Increase Decrease			High Moderate Low
3					Maintain Increase Decrease			High Moderate Low
2					Maintain Increase Decrease			High Moderate Low
1					Maintain Increase Decrease			High Moderate Low
5-6 Total HO/D					Maintain Increase Decrease			High Moderate Low
2-3-4 Total LO/S					Maintain Increase Decrease			High Moderate Low

Explanations:

HO/D: Higher-Order/Deeper cognitive engagement of our students.
LO/S: Lower-Order/Surface cognitive engagement of our students.
Maintain: (% is ok and we should maintain at that level)
Increase: (% should be increased for our school)
Decrease: (% should be decreased for our school)
High-Moderate-Low Priority: Priority rating based upon estimated impact of this change on student academic success for our school's students.

"Measuring Student Cognitive Engagement When Using Technology" was designed to determine if students were using the recently purchased Chromebooks as well as if they were cognitively engaged when using the technology. Data collected using the IPI-T process suggested teachers were typically the users of the technology, students were often disengaged, and teachers were asking students to participate in lower-order surface activities. Missing from the process was the implementation of the faculty collaborative sessions.

The writer scheduled dates to collect data three times during the 2018-19 school year. In addition, faculty collaborative sessions were planned and facilitated within one week of collection data. Participating in each faculty collaborative session, teachers (a) became familiar with the IPI-T Rubric and Protocols, (b) analyzed and discussed the data, (c) identified high-quality examples of student learning that foster student engagement with technology, (d) designed high-quality lessons that foster student engagement with technology, (e) compared longitudinal data and set goals for future data collection using the IPI-T tool.

An analysis of the data revealed when implementing the IPI-T process with fidelity teacher and student technology use increased as did student cognitive engagement when using technology. In addition, it was found that students use technology for information searches the majority of the time rather than media development or to collaborate among peers for example, which are associated with higher-levels of cognitive engagement.

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