

Technology Integration and Critical Thinking

Alena Zink

Kennesaw State University

## **Introduction**

Today, it is almost impossible to find a school that does not have technology resources available to teachers and students. Having technology, however, is not enough to ensure rigorous instruction that provides students with multiple opportunities to develop critical thinking skills, the ability to analyze own thinking with the intention of improving it (McColister & Saylor, 2010). With introduction of the Common Core State Standards (CCSS), elementary school students are expected to analyze own thoughts and explain them in written and/or oral forms, based on the evidence they obtain in the process of learning the content. Even though the CCSS do not specifically define rigor or explain what critical thinking looks like in an elementary school, it is evident that educators are responsible for teaching high-order thinking skills as a part of the English Language Arts and Math curriculums. The CCSS call for robust and relevant applications of basic knowledge, and integration of technology is recognized as a tool for developing such learning environment (CCSS, 2010).

Schools in the United States invest thousands of dollars into different technologies and gadgets to support student learning. However, we do not have enough specific evidence in today's educational research to show that any one type of technology has a bigger effect on critical thinking than another. How technologies are integrated into teaching and learning determines academic outcomes. Focus on strategies for implementation seems to be the most prominent trend in recent educational studies (Armstrong, 2004). With my qualitative study, I investigated the role of technology integration in teaching critical thinking skills at Shiloh Point Elementary School. In order to develop understanding of this central question, teaching experiences of two teachers in the school were explored to develop an understanding the following issues:

- How do student critical thinking skills change when technology is implemented?
- How do teachers choose which technology tools and integration strategies to use when planning lessons focused on development of critical thinking?
- How do teachers know if technology integration strategies affect critical thinking skills in elementary students?
- How does the process of planning and implementing instructional strategies for developing critical thinking skills in elementary students change with technology integration?

The purpose of this narrative study was to explore and describe technology integration strategies used by elementary school teachers to develop critical thinking skills in students at Shiloh Point Elementary School.

### **Definition of Terms**

Critical thinking is an ability to analyze the ways one thinks with the purpose of improving such ability. Critical thinking skills depend on formal learning and can be dramatically improved with integration of effective strategies for teaching critical thinking (Linn & Shore, 2008).

### **Literature Review**

Today, many classrooms in elementary schools lack rigor. Students are not challenged to think critically and have limited opportunities to learn in a collaborative, technology-enriched environment. A wide variety of Web 2.0 and computer-based tools and the introduction of the Bring Your Own Device initiative have brought up a question of their impact on critical thinking of students. Educators want to know if it is necessary to implement technology in order to raise rigor of instruction and how it can be measured.

Many studies have been conducted to help teachers understand what critical thinking is and how different pedagogical strategies may impact students learning of such thinking. Many studies were focused on teaching critical thinking to gifted students. McCollister and Saylor (2010) encouraged educators to “life the ceiling” and infuse instruction for gifted students with critical thinking and academic rigor. They argued that both are necessary to ensure academic growth of gifted students. Four ways to implement teaching critical thinking skills in everyday lessons were described: problem solving, questioning, evaluation of sources, and decision making. The authors illustrated specific lesson activities and strategies to demonstrate what each of the ways look like in an elementary classroom. They also argued that gifted students are able to think critically and on much deeper levels than teachers normally think. Thus, teachers need to assess students’ readiness levels, their interests, and styles of learning in order to successfully carry out each of the described strategies.

To assist teachers in evaluating instructional plans in regard to rigor and critical thinking Hargett, Matusevich, and O’Connor (2009), authors from the North Carolina Department for Public Instruction, developed a rubric for measuring levels of rigor in development of curriculum, instruction, and assessment was developed and tested. Initially, this tool was created for Gifted teachers, but later it became popular with general education teachers across North Carolina and was adopted by East Carolina University in a course for preparation of Gifted Education teachers. As a result, additional resources for measuring and evaluating rigor in curriculum, instruction, and assessment were developed: a special set of questions with specific examples for each was developed to help teachers evaluate their instructional planning and design. This study provided educators with a developed rubric to measure rigor and demonstrated evident of this tool being successfully utilized in creation of rigorous curriculum,

instruction, and assessment. Such tool should be introduced in professional learning sessions of all schools and utilized by teachers during instructional planning and professional collaboration.

Dutchess Maye (2013) went even further with her study. She examined the readiness of teachers to prepare students to be college- and career-ready. She defined the characteristics of rigorous instruction in relation to Common Core Standards and explained the role of Bloom's Taxonomy in the process of aligning instruction, learning, and assessment. The data collected during this study showed that instruction in most observed classrooms lacked rigor and was concentrated in the Acquisition quadrant - "recall of disciplinary knowledge that is gained for its own sake" (Maye, 2013, p. 30). To address this issue, Maye hypothesized and described specific strategies to increase rigor in a classroom. She listed them as professional learning tasks for teachers to implement in daily instruction to improve student critical thinking skills. To improve this tendency, the author suggested Strategic Planning as a method to improve the quality of teaching. The plan was described as a combination of three components: alignment, questioning, and automaticity. Just like the authors of the studies described above, Maye called educators to realize the necessity of job-embedded and relevant professional learning.

It is evident that one of the key issues in effective technology integration is misconceptions or myths about technology integration, often believed by teachers and parents. Such misinterpretation may lead to resistance and unwillingness to try new strategies and integrate technologies into daily teaching and learning activities. For example, Okojie, Olilnsock, and Okojie-Boulder (2006) investigated the false perception of technology integration by many veteran and in-service teachers. The authors portrayed the causes as (1) inability of teachers to plan technology integration during the planning stage of instructional design and not as a stand-alone tool and (2) ineffectiveness of professional technology trainings that are focused

around technological skills instead of instructional strategies for its integration. The authors developed a *blueprint* for technology integration, suggesting to connect technology for instruction to all stages of pedagogical planning and execution of instruction: identifying learning objectives, choosing methods and technology relevant to the objectives and learning activities, evaluating technology integration techniques, designing follow-up and enrichment materials and activities relevant to the instruction, locating and making available additional instructional materials, and designing a vibrant learning experiences for students that support students in discovering knowledge for themselves.

The position that technology should be viewed as a stand-alone tool was also supported by Armstrong (2004): “There is a tendency to think that ICT is so *new* that its use will be accompanied by new pedagogies that will somehow transform teaching and learning” (Armstrong, 2004, p.413). ICT itself does not cause learning, but how it’s used plays a significant role in it. Their work described and evaluated ways of integrating information and communications technology (ICT) in different subjects. This project study examined and described five strands: teaching and learning, policy and management, subject cultures, professional development, and learners’ out-of-school uses of ICT. The study showed that 79 % of teachers (n=229) underestimated the skills and knowledge of their students in computer ownership and skills. In the world of rapidly changing technology, teachers need to learn how to lean on expertise of students to create a community of common knowledge and improve learning.

Professional development is the process that can help teacher clear out some misconceptions about technology integration and learn how to improve pedagogical skills in this area. A two-dimensional model called Pedagogy\*Technology for monitoring teachers’

progression in technology integration and pedagogy was developed and tested by Lin, J., Wang, and Lin, I. (2012). The authors argued that it did not matter how technologically savvy teachers were and what technical skills they wanted and were able to obtain. What mattered was the pedagogy with which they were integrating it into teaching and learning. Participating teachers showed the progress on the two-dimensional grid, but the ways the progress went were very different: while two teachers decided to improve their technical skill, another teacher did not learn any technical skill but changed her pedagogical approach from direct teaching to social learning. Despite the fact that a further investigation is needed to determine which professional learning approach has a bigger impact on student learning, it is evident that both strategies improve student engagement.

Parents play an enormous role in student learning. Their buy-in may be a tipping point in a school plan on technology implementation, especially with introduction of the Bring Your Own Device initiative. Grunwals Associates LLC (2013) examined how parents perceive the role of different technology devices in education. The study involved a diverse group of families, with children from Pre-K through high school. The findings showed that parents of younger students have the most positive position towards mobile learning and its influence on student achievement and the role of educators in influencing parents' opinion is huge. Interestingly, parents of K-2 students had the most support of such learning. Overall, the study exhibited that most parents completely or somewhat agreed that mobile devices support their children's learning and offer many different opportunities for engagement in a classroom. Educators need to continue building communities of learners in which parents play a fair part. Communications about technology integration and its effects on student learning and engagement should be consistent help improve student academic performance.

Even if educators develop lessons that help students improve critical thinking skills and they view technology as an important key of such lessons, they need to know which implementation strategies work better and how much they impact students learning. The work of Lee, Lin, Michko, Waxman, and Wu (2011) reviewed research on the effect of teaching and learning with technology. The goal of this study was to identify effective practices of technology integration. One of the findings was that students working in small groups with computers perform better than individual student working with computers (mean of 0.4 compared to mean of 1.08) and groups of three to five students are more effective than groups of two. Interestingly, the lowest effect of technology on cognitive skills of students was found in grades 9- 12 (0.22), while students in grades K-3 showed much greater results (0.5). According to this study, the most effective use of technology was noticed in remediation skills, finding out about ideas and information, inquiry/investigation, project-based learning, and expressing thoughts in writing. The cognitive outcome had an effect size 0.43 that was larger than many of the past meta-analytic studies. The following effective strategies for technology integration were suggested: collaborate in small or paired groups with computers, develop instruction that is relevant and sense-making in context, and build student basic skills and help them understand interconnections in a project-based setting.

In higher education, Wang, Woo, and Zhao (2009) investigated how interactive online environment effects critical thinking. Specifically, the authors analyzed to what extent writing personal reflections on own learning and online collaboration tasks impact critical thinking. The findings of the study showed that about thirty percent of college students participated in the experiment thought critically while writings personal reflections on what was learned in class. The authors observed that online collaboration is more effective when happens between larger



groups (3-5 people). Educators need to understand that it is not always necessary to conduct collaboration online if participants often see and interact with each other in real life.

Campbell (2012) investigates the impact of technology on writing and critical thinking skills development. In this study, the researchers followed 21 fifth and sixth graders in their learning for two years. The main focus of this study was on digital storytelling in elementary schools and how it enhances student engagement and ability to create higher quality writing. The study showed that the time students spent on task and completion of the project (indicators of engagement used in this study) improved with the implementation of digital storytelling approach in writing instruction (increase from 70% to 96% in time spent on task and from 79% to 100% in task completion) and 92 % of students participating in the study improved their writing skills. The state standardized test results indicated the improvement of writing skills as well. Choosing effective pedagogical strategies in a combination with technology tools used for digital storytelling increased student engagement and overall writing performances.

In contrast to the studies described above, Casto, Taylor, & Walls (2004) investigated the effects of technology on learning with a different approach. They wanted to find out if teaching the same objectives with technology integration would have different outcomes than teaching them without technology integration. The findings of this study proved that the integration of technologies increases the learning. Students in elementary and secondary schools showed greater gains from pretest to posttest the lessons with integrated technologies than students who learned the same units without technology integration.

It appears that more and more educational researchers investigate different strategies for technology integration. Nevertheless, the spectrum of this issue has multiple areas that have

limited data available to us. Specifically, necessary research needs to be conducted on the elementary school level to identify how early introduction to technologies and their implementation in teaching and learning may impact student performance and development of critical thinking skills.

## **The Study**

### **Setting and Participants**

This qualitative narrative study took place in Shiloh Point Elementary, a suburb public elementary school in Forsyth County of Georgia. The majority of students in this school are white (65.1%) with the largest minority group being Asian (16.4%). Approximately 14 % of students are enrolled in the free or reduced-cost lunch program. Nineteen percent of all students are identified as gifted and receive services provided by a team of qualified teachers.

Two teachers from first and fourth grade classrooms at Shiloh Point Elementary participated in this study. They shared their stories of personal professional experiences with technology integration in development of critical thinking skills in elementary students. These teachers were chosen based on their consistent technology integration in daily instruction and high academic student performance data in comprehension and problem solving skills, the two main areas that require proficient critical thinking skills.

The fourth grade teacher (a pseudonym Angela will be used for her in this study) has a Master's Degree in Curriculum and Instruction and holds endorsements in English Second Language (ESOL), Gifted Education, and Reading Recovery. Angela speaks three languages and recognizes the importance of diversity and culturally responsive teaching techniques. She has been an educator for eleven years and taught first, third, fourth, and sixth grades in public schools.

The first grade teacher (a pseudonym Sarah will be used for her in this study) has been a first grade teacher for ten years and worked in multiple public schools in Virginia, Texas, and Georgia. Sarah holds a Bachelor's Degree in Teaching Arts K-6 in addition to ESOL and Gifted endorsements. She is actively engaged in decision making processes in the school as a Data Team leader and represents her grade level on the school's leadership team. Both teachers have been first people who adopted the Bring Your Own Technology (BYOT) initiative in the building two years ago. Since then, they continuously look for new, innovative ways and strategies to meet needs of all learners in their classrooms. Sarah and Angela often present and lead professional learning sessions on the school, county, and state levels. Both teachers have been recognized as exemplary teachers by the Professional Learning on Demand organization (PD 360), and their teaching techniques were filmed as professional learning resources for educators around the country. Sarah and Angela are recognized by the administrators and staff as educational leaders in the building for their pedagogical knowledge, rigorous instructional planning, and continuous professional growth.

### **Data Collection and Analysis**

For the purpose of this study, the participants were asked to tell their stories of individual professional experiences in facilitating critical thinking learning with technology integration on a daily basis. Personal interviews were conducted to collect field texts: narratives from the participants about personal experiences, descriptions of observed strategies in the classrooms, and student work examination by the researcher. The interviews were recorded and allowed the researcher to collect raw data. In addition to listening to the natural flow of teachers' stories, the researcher asked specific questions to develop a deeper understanding of technology integration

strategies for teaching critical thinking to students and describe the chronological progress of pedagogical skills for doing so.

After collecting raw data from the interviews and observations, the researcher analyzed and interpreted it by retelling the story in own words, identifying themes and/or categories of information, coding them, and tracing chronological information. During collection of data, the researcher constantly collaborated with the participants to ensure the information was presented objectively and interpreted correctly by the researcher. The narrative was written in a storytelling mode. However, the researcher evaluated field texts based on their depth, accuracy, and realism of account. Collected data allowed the researcher to look for and evaluate possible common trends and categories and develop a list of strategies for technology integration in teaching critical thinking skills.

### **Findings**

A number of themes were developed from the analysis of the teachers' stories, classroom observations, and evaluation of student work and/or teaching materials. However, I chose to highlight and report only those themes that were relevant to the purpose of this study: to explore and describe how technology integration impacts critical thinking skills of elementary students. The participants come from very different cultural and professional backgrounds, but the professional experiences in teaching critical thinking skills with technology integration were very similar in their nature.

First, the participants described the metamorphosis through which their teaching styles and techniques went with technology integration. Both teachers expressed that availability of technology and appropriate professional development inspired the change and challenged them to become more effective teachers and enhance students' development of critical thinking skills.

The mindset about the role of classroom teachers shifted from knowledge givers to facilitators of learning. Second, both teachers strongly advocated for developing student-centered classrooms where elementary age children take ownership of their learning, think critically, and have a choice of technology tools in the process. Finally, teachers shared some strategies for teaching critical thinking skills with technology in elementary classrooms. They portrayed positive impacts of technology integration on student academic growth and thinking skills observed in their classrooms for the past two-three years. In the sections that follow, I explained each of these themes in details with reflections, the participants' quotes, and some supporting documents. The purpose of the following report was to explore and describe technology integration strategies used by elementary school teachers to support critical thinking skills development in students at Shiloh Point Elementary School.

### **Shift in Mindset about Teaching**

The intensity and expectations for technology integration in teaching and learning dramatically changed in the past four years. Shiloh Point Elementary embraced new tools and made multiple types of technologies available to teachers and students. Two years ago, Shiloh Point adopted the Bring Your Own Technology (BYOT) initiative which allowed all students and teachers to bring their own technologies to school to use for teaching and learning. Evidently, having and using technology in the school became a norm. When talking about different types of devices being in hands of her students, Sarah noted: "When I got those iTouches, it's all kick-started...It felt natural. As I was exposed to it [technology] more, I embraced it when it came my way." Likewise, Angela explained that she did not use much technology three years ago because "it wasn't on the platter." Both participants agreed that the availability of a variety of technology tools promoted their professional growth and fostered

implementation of new strategies for technology integration that increased student critical thinking and overall academic performance.

However, having technology tools available does not always mean it will be used effectively. In their interviews, both participants clearly identified themselves as constant learners who are not afraid to take risks in finding new, effective ways to integrate technology in their classrooms. “It’s important to learn *what* to do with it [technology tools] than how to use it,” explained Angela, stressing the importance of the content being the main focus when planning lessons with technology. She observed that the teachers on her team are currently at different levels. “About 50% are using it [technology] for the sake of using it and not thinking about how it may help kids learn to think. It’s cool and snazzy, and it’s exciting, but there is nothing really behind it.” During my classroom observations, high-order thinking questions (depth of knowledge level 3 or 4) were evident in every stage of the lesson in both classrooms. Technology did not seem to be a learning target, but a tool to enhance critical thinking and promote collaboration and communication among students.

Both participants felt that working in isolation is not the most effective way to embrace technology tools. In addition to collaborating on lessons with the media specialist and instructional technology coach, Angela built her own professional learning community on Twitter. “I explore a lot. I’m comparing and evaluating these things [shared resources] ...I am trying to do the same thing I want my students to do: think critically and evaluate what’s online” (Angela, personal communications, February 5, 2014). Sarah prefers to learn from and with her students, besides referring to the resources provided by the instructional technology specialist in the building. “I get new ideas about tools from the kids. They will bring them in and show me, and I love it because it is coming from them,” said Sarah. Both participants model how to be

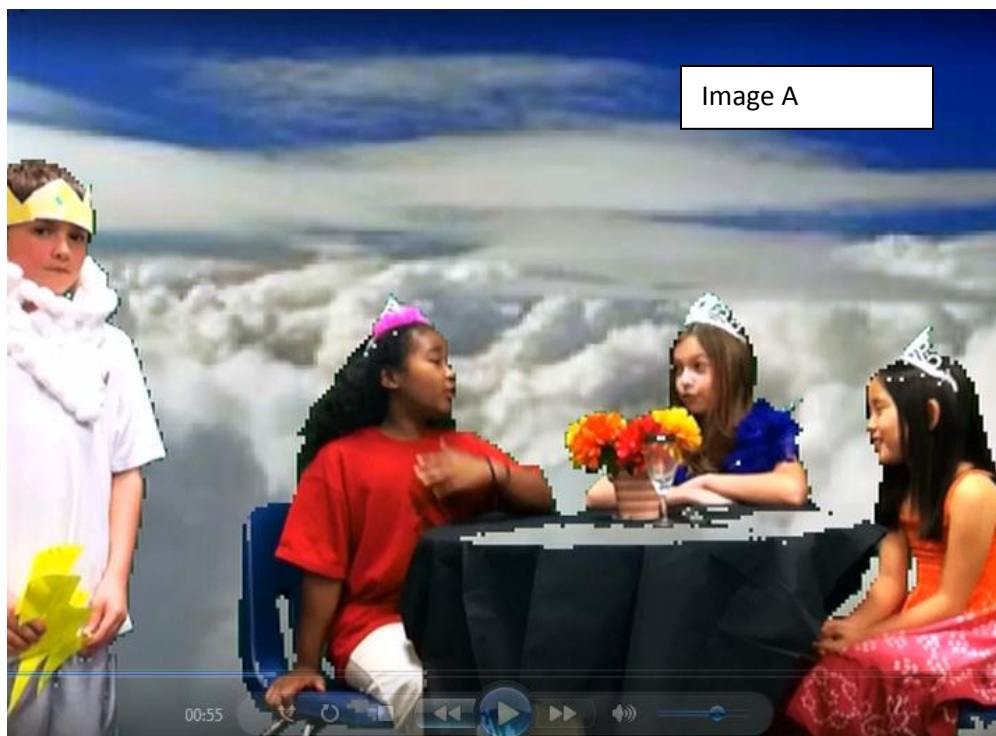
constant learners to their students on a daily basis. In my observations of the first grade classroom, Sarah was not afraid to say *I do not know* to her students and encouraged them to ask each other about how to use a technology app/tool while she was listening and learning with and from them. Being a constant learner seemed to be a strand that was common in these teachers' successful technology integration.

### **Student-Centered Classrooms Promote Critical Thinking**

The participants in this study observed that students think critically and learn to evaluate own thinking if their environment is a student-centered classroom. If, according to Sarah, critical thinking is the ability of problem solve effectively and independently, then teachers need to provide ongoing opportunities for such learning every day. "Critical thinking is a subject of its own," noticed Angela, as she responded to my question about the place of critical thinking skills in the elementary curriculum. "Students need to learn to take the knowledge they've learned and apply it to real-life situations without asking for help right away" is the definition of critical thinking skills given by her. In unison, Sarah pointed out that "students must step through the process [learning] instead of it [knowledge] being spoon-fed to them." Such learning is impossible in a classroom where the teacher is the sage on the stage. If students must learn to own their learning, then teachers are responsible for providing opportunities for them to do it on a regular basis.

Throughout the interviews, I caught myself thinking that these teachers did not see technology as a center piece in teaching critical thinking. It is simply a tool, an invisible one, that can only be as powerful as the quality of instruction, questioning, and technology integration is. Technology itself does little to improve thinking skills. The pedagogy with which technology is implemented plays the sole role in improving critical thinking skills. Both teachers

described how students choose technology tools independently to demonstrate what they learn in any way they found appropriate. These teachers do not plan templates or graphic organizers for students to fill out. Deep, open-ended questions drive their lesson plans instead. A “snazzy” technology product is not even a goal. “The steps that they [students] are building towards that end result is all critical thinking because they develop those ideas on their own to come up with that final piece” (Sarah, personal communications, March 10, 2014). Below are examples of different technology tools students chose to show what they learned from Greek mythology. Image A is a snapshot of a green screen video. Students played roles of different gods and goddesses to explain the meaning of the myth they interpreted. Image B is a snapshot of an animation completed in Puppet Pals, an iPad application. In both examples, critical thinking, collaboration, and communication helped the students own their learning and integrate technology tools to enhance their understanding and creativity.







Angela agreed that when technologies are chosen by students, it “automatically makes them evaluate their own work, which itself is critical thinking because they have to stop and think of the process.” In her fourth grade classroom this year, students wrote blogs to analyze and evaluate their own learning. They used technology to think critically about what they learned. In Figure 1, an example of a student blog reflects the depth of knowledge developed about Native American tribes. Critical thinking was evident in the post, and technology enhanced it and allowed students to expand the audience beyond classroom walls.

Figure 1: Student Blog Entry



### Seminole Tribe: Want To Go?

I would never ever go back to see my great great great great aunt Sastuivy because she was part of the Seminole tribe. I want to meet her, but I think the Seminole tribe is terrible! Here is why.

The Seminole tribe lived in houses called "chikees." Which sounds like chickens but they actually look like the picture above! Chikees are made of wood and plaster. The Seminole grew corn, beans, and squash. Men hunted deer, wild turkey, rabbits, turtle, and alligators. They also ate fish. Do you want to eat an alligator? Seriously, an alligator. Think about the scales and the eyes too. Anyway, here is one of their dishes they ate below

The Seminole lived in Florida. It was very warm so men wore breechcloths and women wore wrap around skirts. here is some of the seminole's clothing tapestry. I think it is actually cool!!!!!! But, I still don't want to live with the Seminole tribe.

The Seminole tribe was not the nicest tribe. They used many weapons. To catch fish they used fishing spears. They used bow and arrows for hunting. Starting 1700s they also fought with guns. Do you really wanna live with a tribe that has guns and bow and arrows everywhere? I know I don't here is a picture of there weapons.



Well, now I hope you know that the Seminole is a nasty tribe. But you might just wanna go grab your time machine and see for yourself.

And a special thanks [www.wikipedia.org](http://www.wikipedia.org) for pictures and [www.bigorin.org](http://www.bigorin.org) for facts

### **Strategies for Teaching with Technology**

Technology integration does not simply happen in these classrooms on its own. The participants explained the importance of establishing a collaborative and safe learning environment for students at the beginning of the year so they feel comfortable to ask questions, lead own work, make mistakes, and take risks. Sarah said that such setting is crucial if we want students “to have that independence and to be able to really develop ideas on their own.” Modeling and scaffolding are two strategies that both participants found most important when teaching students think critically when working with technology.

These teachers prompt and guide students in choosing technology tools and help them learn how and what tools can make work efficient while perfectly fit a task. Such learning makes students “think critically as to how to do, achieve that learning target set by the teacher” (Sarah, personal communications, March 10, 2014). Angela’s students chose technology tools independently, but they were expected to defend their choices, explaining why it was good or better than the options given by her. In Angela’s opinion, the process of evaluation and persuasion made students think critically even before they started working on the task.

The participants noted that teaching students how to manage time and monitor their progress when working with technology is very important, too. Teacher expectations for learning outcomes should be clear and referred to throughout the learning process. Angela recommended using rubrics that help students see the connection between the “cool and snazzy” technology tool they chose and the content that they learned. The teachers believed that every standard in every curriculum can be built on critical thinking. Sarah was convinced that it’s a “teachers’ choice to interpret how they are going to make their classroom a critical thinking

classroom.” Teachers have power to decide how deeply they want their students to think, just as they choose (or not) to expose students to technology tools in everyday tasks.

### **Technology Impact on Learning**

The participants became avid technology users only three years ago. I asked them to describe what changes, positive and/or negative, they observed in their students when technology was integrated to support critical thinking exercises. Both participants agreed that technology offers multiple avenues for students’ curiosity and learning. Angela was sure that with technology “the road [of learning] is longer and windier.” Sarah added a similar thought: “It enhances learning because the possibilities are endless.” When asked if teaching critical thinking can be successfully achieved without technology in a classroom, both teachers immediately agreed that it would be possible, but the opportunities for learning and sharing knowledge with people outside the classroom walls would be impossible. “It’s their world now, and it is a crime to take it away from them,” says Angela. Students learn how to think critically when they use it, whether it is an online communication, resource, or discovery of a new application.

Both participants also noted that technology increases student engagement. It captures their interests quickly and keeps it as long as any “hook” strategy teachers may implement. Technology motivates students and promotes communication and collaboration between them. Sarah described how powerful it was to watch her first graders “sitting at the computer, puzzling over their questions, and taking turns with the mouse.” Technology offers unique opportunities for students to work together, discover new things, expand their vocabulary, and become contributors of knowledge. In addition, technology provides immediate feedback to students, which helps teachers personalize and differentiate learning in a classroom.

### **Discussion**

This study was inspired by the changes that took place at Shiloh Point Elementary in the past two years. The implementation of the BYOT initiative forced many teachers to rethink their teaching strategies and approaches, take risks, and look for innovative ways to prepare students of today for success in the future. A number of teachers, especially those who were hesitant about technology integration, were skeptical about the impact technology has on student learning and development of critical thinking. This study focused on exploring teaching experiences with technology integration of those teachers whose passion about the BYOT and strong knowledge of instructional design have impacted student learning and showed gains in critical thinking skills and overall academic performance of their students.

In conclusion, this study showed that technology tools in isolation may become very meaningless and have no impact on critical thinking skills. High-order level questioning, consistent high expectations for learning outcomes, and a student-centered learning environment are major characteristics of successful technology integration in an elementary school. Teachers must challenge themselves with new knowledge, skills, and teaching methods. They must critically think how to make technology an invisible, but powerful tool that helps students think critically, be creative, and collaborate with each other.

The purpose of this narrative study was to explore and describe technology integration strategies used by elementary school teachers to develop critical thinking skills in students at Shiloh Point Elementary School. I hope the examples of student work and teaching experiences shared by the participants helped readers develop a vivid picture of what it looks like in these two classrooms. I described the changes and challenges that the teachers had to overcome to

tune their teaching craft to students' needs and invest in our collective future by helping students grow up to be independent and critical thinkers.

As my recommendation, I would like to note that educators need to hear success stories of those teachers who take risks with technology and demonstrate academic growth of students in their classrooms because of that. Educational researchers need to investigate and measure the impact of technology on critical thinking, as well as other specific academic and socio-emotional areas of students in elementary schools. Teachers need to know how technology impacts learning of young students; therefore, there is a definite need for educational research in this area.

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## Appendix

### Interview Protocol

Institution: \_\_\_\_\_ Date: \_\_\_\_\_

Interviewee (Title and Name): \_\_\_\_\_

Interviewer: \_\_\_\_\_

#### Introduction:

You have been selected to speak with me because you have been identified as a teacher who is consistent with technology integration in daily instruction and has high academic student performance data in comprehension and problem solving skills, the two main areas that require proficient critical thinking skills. My research project focuses on exploration of technology integration strategies used by an elementary school teacher to develop critical thinking skills in students at Shiloh Point Elementary School. This study is not to evaluate your teaching techniques and experiences, but to tell a narrative story of your practices in technology integration and how it affects teaching and learning critical thinking skills of elementary students.

I have planned to interview you for an hour. Later, we will spend more time discussing this study. I will provide you with a written narrative of your experiences and ask you to ensure I represent your beliefs and experiences objectively, clearly, and correctly.

During this time, I would like you to cover several questions. I will be taking notes as you answer the questions. You need to understand that it may be necessary for me to interrupt your narrative in order to complete all questions and/or clarify your responses. All information your share will be confidential, your name and the names of your students included. Your

participation in this study is absolutely voluntary and you may stop at any time if you feel uncomfortable. Thank you for your agreement to participate in this study.

Interviewee Background:

- How long have you been teaching?
- What teaching experiences do you have?
- How long have you been teaching at Shiloh Point Elementary?
- What certifications do you hold? What is your highest degree?
- Briefly describe the students with whom you work.

### **Technology Integration and Critical Thinking**

- Throughout your teaching career, have you always integrated technology in your classroom? If not, please describe what made you change your mind?
- Describe what teaching and learning critical thinking skills look like in your classroom.
- Do you observe any changes in student academic performance, specifically in critical thinking skills, when you/they utilize technology?
- How do you choose technology tools and strategies with which they are integrated into your lessons?
- What resources help you know what technology tools and how to integrate them to teach students critical thinking skills?

Other Topics Discussed: \_\_\_\_\_

Post Interview Comments or Leads: \_\_\_\_\_