Fall 2015

The Impact of Technology on Primary Education

Kathryn Holt
California State University, Monterey Bay

The Impact of Technology on Primary Education

Kathryn Holt
LS 400-01
Senior Capstone
December 2015

Table of Contents

Abstract

Using technology and computer science to facilitate learning as well as its role within education is important to understand as technology plays a dominant role in daily life. The availability, affordability, and efficiency of technological devices and tools have benefitted both students and educators. Technology usage has increased as students with learning disabilities use different technological devices to support their needs, as well as teachers using assistive devices to directly identify students' needs. Additionally, with the integration of technology and educational applications with lessons or texts, teachers provide students the opportunity to expand their learning through different forms of media, and engages students who learn through various cognitive learning styles the opportunity to connect with information in their own way. What technology in the classroom ultimately provides students is the opportunity to explore autonomy within themselves, while still receiving the academic support and structure needed to succeed within education and prepare them for real-world experiences.

Liberal Studies Major Learning Outcomes

Through my time at California State University, Monterey Bay within the Liberal Studies program, some of the classes I have taken have fostered my drive and helped me develop my identity as an educator. I credit much of my growth to professors such as Dr. Scott Waltz, Dr. Jaye Luke, Dr. Rebecca Bales, and Miriam Kodl who have helped me expand not only subject matter but what it means to be a successful educator through their classes and unwavering and continuous support outside of them.

Dr. Waltz cemented my "general knowledge, skills, dispositions, and responsibilities of a California public educator in classroom, school, community, State, and National contexts" (Liberal Studies) through both Innovated Approach to Schooling (LS 383) and Social Foundations of Multicultural Education (LS 398). Through learning about the creation and evolution of modern schooling, I developed an understanding of the role of an educator within the institution of schooling and classroom setting. Additionally, Dr. Waltz introduced me to various types of educational theories and practices, from virtual to Montessori to alternative education, further developing and expanding my own professional practices. Exposure to these different educational practices and contextual information about the institution of schooling helped develop myself as an educator while fulfilling the Liberal Studies Major Learning Outcome #1: Developing Educator.

Student populations are increasingly diverse, especially in California public schools which is why the Liberal Studies Major Learning Outcome #2: Diversity and Multicultural Scholar is so prevalent today. With students of various backgrounds present in classrooms, it is important as an educator to be sensitive and aware of the differing cultures as well as being an advocate for social justice both in and out of their classroom. Through Multicultural Literature

for Children and Young Adults (LS 394), Teaching for Social Change (LS 380), and Diversity in Educational Settings (LS 391) I have expanded my knowledge about different cultures and developed an appreciation for multiculturalism as well as learned different ways to incorporate multiculturalism into classroom curriculum. I demonstrated knowledge of "historical and contemporary perspectives" and the "the value of diversity and multiculturalism" (Liberal Studies) through writing and implementing a curriculum on multicultural literature at Learning for Life Charter School as part of Multicultural Literature for Children and Young Adults.

While both Dr. Waltz and Mrs. Kodl particularly have personally helped and encouraged my technological education, not many Liberal Studies classes have fostered a technological education despite the Major Learning Outcome #3: Innovative Technology Practitioner. Through my capstone project however, "Computer Science and Coding in Primary Education," I will be able to demonstrate and educate students and educators about different technologies and computer science skills available for curriculum development and classroom aid. Additionally, I will expand my own knowledge on computer science and technology skills through training with Embark Labs and writing curriculum.

Through taking classes such as Teaching for Social Change (LS 380), and Social and Political History of California (SBS 386) with Dr. Bales I became more aware of social issues and how to fight for student equity. Understanding the historical context of social issues is important to understand current societal structures and be socially responsible. In Teaching for Social Change, I learned how as an educator how to pursue social change and work within educational institutions to be an ethical ally to students and social groups in need. These experiences have helped me increase social awareness, fulfilling the Major Learning Outcome #4: Social Justice Collaborator.

Lastly, in my pursuit of a career in education, I have successfully taken both the California Subject Examination Test (CSET) for Multiple Subjects and Writing Skills. I believe that my time in classes such as Chemistry I (CHEM 110), Introduction to Earth Sciences (GEOL 210), and Growth and Conflict in the United States to 1920 (SBS 315) as well as various study materials have helped me pass the required CSET tests as well as meeting the Major Learning Outcome #5: Subject Matter Generalist.

Introduction

As technology continues to advance and be incorporated into different professions it is important for students to proficiently use technology and possess the required skills. By providing and enacting a computer science curriculum, students would gain knowledge and real-world application of vital computer science, math, and communication skills, such as programing, coding, and collaboration. Additionally, with the implementation of a computer science curriculum in low performing schools, students who would not traditionally have exposure to technology would develop interests, skills, and experiences in real-world opportunities and careers.

After volunteering in low-performing primary schools, I noticed the lack of exposure to technology most students experienced. Many of these students live at or below the poverty level as well as being English Language Learners. With parents that worked multiple jobs and had little time to participate in their child's education, these students had little support completing their assigned homework or expressing their thoughts and dislikes about their own educational experiences. Some students do not even have internet provided for them at their home, a basic technological tool many take for granted. Since these students have little to no resources, technologically or educationally, they are immediately disadvantaged and behind their peers who have opportunities to experience the benefits of technology. Seeing how little exposure some students have to technology and the information or opportunities it provides is a motivating factor to provide computer science and technology instruction in low performing schools.

Through working at CalStateTEACH, a teacher preparation program, I have seen the immense need for teachers that possess technological skills and feel comfortable teaching computer science. As new educational technology keeps advancing and opportunities within the

science, technology, engineering, and mathematics industry emerge, it is vital for teachers to understand and be able to effectively teach students. Teachers often are given little to no resources or time to explore curriculum alternative subjects, such as computer science, especially with the implementation of the new Common Core curriculum. With an easy to understand computer science curriculum teachers are then given the opportunity to use it in their own classroom and open students to a new experience. While some of the lack of computer science instruction is attributed to the slim budget with which schools are provided with, many teachers themselves do not possess computer science skills or do not know how to utilize technological resources the school does have available. This leaves their students at a disadvantage as they are not being taught important, real-world skills that directly impacts their future education and possible opportunities. However, there are many technological tools, such as iPads, Chromebooks, and SmartBoards, and educational applications, Class Dojo, Kahoot, and Daisy the Dinosaur, that positively affect students' educational experience and could easily be utilized.

I recognized further the importance of computer science and technology skills after attending the NASA Ames Pre-Service Teaching Institute in Mountain View, California. There I met current teachers and learned how they incorporate science, technology, information, and math in their own classrooms and how they see the need for further education on such subjects to continue to expand. I also was fortunate enough to meet with NASA employees from both their research divisions and education departments, where they showed how even basic coding skills students can learn at an early age are vital to the work that they and many others do daily. While I consider myself technologically advanced, this experience opened my eyes to how much more technology is available to use, both in apps and programs and physical devices, and how much more I needed and wanted to learn. I was able to further my skills through this internship,

however, it also made me realize how much I was missing out on, as a student and future education.

Framing a capstone project on computer science in elementary education could take many routes. It would be interesting to do a comparative analysis on how students perform in schools that do teach computer science skills and schools that lack technology curriculum or even student performances in STEM curriculum and fields compared to students in European schools where computer science and technology is an integral part of their studies. Writing and delivering a curriculum in computer science and coding in multiple schools or across multiple grade levels would additionally be a realistic frame for a computer science in education capstone. A third viable option for creating a capstone would to be to do an inservice for elementary school teachers on the importance of computer science in elementary education and different opportunities, curriculum, and programs available for teachers to use in their classroom.

For this specific project, however, I will be using a combination of research on technology and computer science in education as well as comparing the European students who receive a computer science education to American students who do not. I believe this will provide me with a well rounded understanding of the importance of computer science in elementary education and the importance in a global context. This will also assist me in writing curriculum in the future on how to appropriately incorporate computer science in a classroom and further my own understanding of computer science.

When looking at computer science and technology in education, I will be looking specifically at how technology has shaped educational practices and theories. I will research how technology, including computer science, affects students' behavior both socially and within a classroom setting. I am fortunate enough to be partnering with Embark Labs, a non-profit

organization whose goal is to "help schools teach kids computer science by doing real projects together" (Embark Labs, 2015). Through working with Brian Van Dyck, the Director of Curriculum and Instruction of Embark Labs, I will be able to further my own computer science education and gain additional resources to use for my project and the school in the future. I will additionally be looking at schools in Europe who implement computer science in their curriculum and their American counterparts.

To do this, I will be interviewing people from a variety of professions, such as educators, administrators, and computer science engineers to see the importance of computer science in education and real-world applications as well as how a foundation in computer science affects both students' educational and professional careers. I also would like to include interviews with parents, especially parents of students who have a social or mental learning disability, to see if using technology influences their students' behavior or learning process. I will additionally be using data and information on student knowledge and retention of computer science from both American and European school programs.

Research

The progression of technology and its usage has always influenced how humans interact with their environment and peers. From Johannes Gutenberg creating the printing press to Henry Ford introducing the assembly line, humans have been constantly surrounded and enamored with technology and its advancement. With everyday technology being constantly redesigned or created, how society reacts and interacts to these challenges is vital. Using technology and teaching basic computer science skills within formal education has been proven as an effective solution to help younger generations understand technological advancements as well as enabling them the opportunity to be a part of technological change in their future. How technology and computer science can be used to facilitate learning as well as its role within education is important to understand as technology plays more and more of a dominant role in daily life.

Technology is simply anything that aids activity in daily life (Cruz-Uribe, 2013) which can range from complex machinery such as drones and Mars rovers to simple, mundane tools like forks and chairs. The reliance humans have on technology is incredible and often goes unnoticed, however most of the global focus on technology falls upon complex machinery, such as computers, phones, and applications. These tools have had an incredible impact on human behavior and interaction; Facebook, an interactive social media website, for example, saw approximately 1.39 billion active users in early 2015 and 83.7% of those users checked their profiles every day, if not multiple times, on a mobile phone or app (Halleck, 2015). The challenge these technologies, like iPhones, Facebook, and Chromebooks, and even other basic technological tools, such as watches, microwaves, and radios, is how to keep progressing and improving the physical devices and software to parallel the demand of its users.

The growth of technology had progressed incredibly, and the inclusion of technology within classrooms has transformed education. Incorporating computers into primary education began in 1965 with the passage of the Elementary and Secondary Education Act. This legislation was meant to bring new technology and minicomputers into schools, however most of the computers brought into primary schools were used for administration and counseling purposes ("History of Computers...", 2008). It wasn't until 1984 that computers were beginning to populate schools across the United States with about "31 states using 13,000 PCs for career guidance...but there were still relatively few computers in classrooms" ("History of Computers....", 2008). By 1988 with the creation of the Apple Macintosh computer, however, 60% of American workers used computers and by 1990, multimedia personal computers were developed as well as video discs and other multimedia tools for schools across America ("History of Computers…", 2008). Combined with the Internet and world wide web accessibility and the continued improvement of multimedia tools for students and educators, by 1994 "most US classrooms now had at least one PC available for instructional delivery" ("History of Computers….", 2008). In a large-scale, national survey published in the International Society for Technology in Education journal "an increase of teacher use of technology but not as a productivity tool for students between 2005-2007" (Means, 2010) was reported, showing technology's increasing influence and usage in classrooms.

Education has seen a dramatic influx of technology usage as well as how both students and teachers interact within the classroom (Raskind, 1998). Common technology in the classroom can vary from projection systems to laptops, however assistive technology is an integral part of educational technology that is often forgotten. Since the passage of the Technology-Related Assistance for Individuals with Disabilities Act in 1988, awareness and

usage of technology in education has increased (Raskind, 1998). Assistive technology devices, such as hearing aids, teacher microphones, and magnifying glass for students, is defined as "any item...that is used to increase, maintain, or improve functional capabilities of individuals" (Raskin, 1998) and the range at which technology can help students within the classroom keeps expanding. Assistive technology in classrooms now even includes web-based programs such as TechMaxtrix where teachers, parents, and students can all interact with specific lessons for students with disabilities and resources like AEM Navigator, a decision making application that help educators identify and design Individualized Education Program ("Assistive Technology...", 2015). The wide variety of mobile technology commonly available to students and educational institutions combined with the fact that students with learning disabilities are the "single largest contingent of students...being served on American campuses" (Raskind, 1998) is only going to further fuel the usage of technology within American educational institutions.

Since the new millennium, the incredibly rapid progression of technology within the classroom has continued. "Technology has dramatically changed...where there was one computer in one room and it took 24 hours to get information back" (Flores, interview, 2015) to currently, where many primary schools across the United States have a school-wide computer lab or even classes that have a 1:1 program, in which each student in the class has access to an iPad or other mobile device. Especially with mobile devices, students "can feed their curiosity about subjects" and even share or help their fellow students before the teacher has an opportunity to (Carey, interview, 2015). "In some cases textbooks are secondary to researching online" (Carey, interview, 2015) especially since access to technology and the Internet provides students with immediate and unlimited information. The concept of instant gratification when it comes to students receiving data and information combined with the multimodal interface technology

provides students has changed how students process knowledge as well as their ability to work with abstract constructs (Journal of Educational Media, 2002).

In the current, dominant form of industrialized education, students learn through a vertical method where the "thought flow is immediate, direct, and basically adequate" (Waks, 1997). Vertical thinking is highly compatible with the traditional teaching method of receiving and memorizing information from a teacher because it involves logical, natural thinking and avoids alternatives (Waks, 1997), which helps the teacher to "stand and deliver" the necessary curriculum to a classroom all at once. While vertical thinking is effective from an educator's viewpoint as a constructive classroom management technique, vertical thinking limits students on their abstract thinking skills and does not teach students to challenge the given information or circumstances. To improve both retention and cognitive functions, students need to learn in an environment that balances both vertical and lateral thinking. Lateral thinking, conversely, restructures thinking patterns of students and places an emphasis on the process rather than the outcome (Waks, 1997). It additionally allows learning to be student driven and student participation is unavoidable (Journal of Educational Media, 2002). Using technology as an effective teaching tool and for student engagement, students are able to have a successful hands-on, experiential education (Waks, 1997). Through integrating technology and educational applications with lessons or texts, teachers provide to their students allow students to "make connections between what they learned through the two modalities" (Means, 2010) and provides students who engage with learning differently through various cognitive learning styles (visual, auditory, and kinesthetic) the opportunity to connect with information in their own way.

Teaching computer science through coding is one of many ways a technological curriculum improves student retention and cognitive thinking. Computer science is essentially

how computers interact and interpret data from their environment using a language of their own called binary code (Van Dyck, 2015). By introducing the abstract concept of translation between "human language" and binary code, students use vertical thinking to conceptualize something they physically cannot see. The skill of coding, which is writing out binary code or specific functions for computers, can be taught multiple ways, from computer programs and apps to kinesthetic lessons, and is "more about the process of breaking down problems than coming up with complicated algorithms as people traditionally think about it" (Chilcott, 2013). However, understanding coding and that each function or piece of code has a specific outcome, students complete coding through lateral thinking and structure. Additionally, students learn "logic, sequential thinking, practical application of mathematics and scientific principles (Carey, interview, 2015). Students with the ability to use these technological and cognitive skills are more likely to be logical, consistent, and systematic in their academic studies and more likely to solve unfamiliar problems both in and out of the classroom (Gulga, Kay, Lister, & Kleitman, 2013).

This method of supplementing traditional lessons with that of an online, educational program or technology was exemplified at CalStateTEACH's Summer Lab Schools. CalStateTEACH is a California multiple subject credential program that has been recognized as an Apple Distinguished Education Program since 2012 and provides local elementary school children with lab schools over the summer to improve on their literacy, math, and computer science skills. During May and June of 2015, CalStateTEACH hosted twelve different lab schools across California and used iPads and Raz-Kids, an "innovative reading program" to provide additional support to students in grades Kindergarten through fifth (CalStateTEACH, 2015). Students in the literacy programs had different reading centers they rotated through,

including a Raz-Kids center two to three times a week, where students participated in a pre- and post-assessment to gauge their fluency, accuracy, and knowledge of sight words. Additionally, the Raz-Kids program offered students differentiated reading levels and instructions based on their pre-assessment level, interactive vocabulary and content lessons. To further assist students with their literacy skills, Raz-Kids also provides a program designed to improve student fluency where the student reads back to the mobile device or technology the literature of their choosing based upon their literacy level. This combination of technology and traditional instruction, with both lateral and vertical cognition, proved to be a successful method for teaching to many students at multiple literacy levels within their own grade.

One of the schools CalStateTEACH worked with was the East Oakland PRIDE Elementary School, a Title I school with limited technology and resources for both teachers and students throughout the traditional school year. During the Summer Lab School, however, the Kindergarten students at the East Oakland PRIDE Elementary School demonstrated the greatest growth of literacy accuracy through using supplemental technology. The Kindergarten students on average improved their reading accuracy by 25.67%, with an 88.67% overall accuracy of reading sight words (CalStateTEACH, 2015). Teacher candidates were able to provide more individualized instruction for each student based on their progress on Raz-Kids and students were able to progress or further develop understanding at their own pace, which contributed greatly to increased literacy comprehension. By the final week of the East Oakland PRIDE Elementary School Summer Lab, 88.88% of the Kindergarten students in attendance "exceeded their reading level by one or made progress in accuracy" (CalStateTEACH, 2015) through both supplemental technology and increased direct instruction.

A similarly structured literacy lab was additionally conducted at El Gabilan Elementary School in Salinas. El Gabilan is also a Title I school, with 90% of their students qualifying for free or reduced lunches and an API score of 736 ("El Gabilan Elementary School," 2014). The students participating in the El Gabilan Summer Lab School had a similar educational structure to their peers at the East Oakland PRIDE School; they participated in rotating literacy centers with one including iPads, headsets with microphones, and the Raz-Kids literacy program. The usage of technology through instruction, the Raz-Kids application, as well as interactive instruction, using iPads, contributed greatly to the academic strides the fifth grade students made throughout their instruction at the Summer Lab School. The majority of the students were English Language Learners (ELL's) and began the program with an average of 76.61% fluency and an average 83.0% accuracy reading level (CalStateTEACH, 2015). By the end of the Summer Lab School, the fifth grade students were reading with an average of 95.30% fluency and 91.0% accuracy (CalStateTEACH, 2015). Raz-Kids, combined with traditional reading instruction, dramatically improved the students' reading abilities as well as exposing them to technology (iPads) and electronic resources (Raz-Kids) that they did not have both at home or in their traditional school setting.

Technology and its applications in the classroom furthers student retention and knowledge beyond being provided supplemental information and advanced instruction. Technological devices and the ability for students to use technology to discover and manipulate information provides students the opportunity to use their coursework for "humane, informative, and intelligent utilization" (Waks, 1997). Students who have researched, created, and presented information that was pulled together through multimedia resources on technological devices have greater metacognition (Gulga, Kay, Lister, & Kleitman, 2013) as well as increasing their

own sense of autonomy. Since a technological education is driven by student's' needs, "the learning process becomes more tailored because there is more freedom" and have more control over their own learning process (Carey, interview, 2015). Students have more hands-on, experiential learning with direct, technological instruction and with that freedom of leading their own learning, students develop autonomy (Embark Labs, 2015). Through using technological devices and programs, students become more invested in their own education "because there is more freedom" (Carey, interview, 2015). When students are more involved and active in their own education at a younger age, their self-confidence, work ethic, and interests continue to grow and benefit them in their future educational and professional lives.

A prime example of the socio-emotional and academic benefit of a technological education is evident in Israel and their educational system. In 1995, Israel underwent a "substantial reform through the massive introduction of an integrated science-technology curriculum" especially in vocational training classes since about 50% of the senior high school population of Israeli schools take vocational training classes (Waks, 1997). The changed curriculum "decreased practical or vocational contents" while promoting the advancement of science, technology and math (Waks, 1997). Teachers underwent intensive teacher trainings and the standard curriculum was constantly updated to place an emphasis on improving skills and knowledge among low performing students (Waks, 1997). The impact of the revised curriculum has been shown on both an academic and national level. It was found that students, while they were being challenged and shown the practical application of technological skills, voluntarily took and passed exams that were up to two times above their dicated academic level (Waks, 1997). The Israeli economy quickly became "one of the most resilient technologically-advanced market economies in the world" and is ranked first world-wide for the "availability of scientists

and engineers and number of start-ups per capita" (The Israeli Economy Today). Additionally, with high technology industries being its major industry, the unemployment rate of Israel is currently 7.4% (The Israeli Economy Today).

Technological education for students has been heavily influential in South African schools as well. In 2002, the Technology Across the Curriculum Project, TeACup, was developed and teachers in South Africa attended teacher training with a focus on updating and implementing technology in curriculum especially across rural schools (Makgato, 2014). Teachers participated in TeACUp training for two months, receiving information on how to use technological devices and programs efficiently in curriculum to benefit their students as well as training on how to use the devices (Waks, 1997). Teachers found that engaging students in group work and discussions was simple and effective using technological devices and students responded positively to using technology and learning relevant materials (Waks, 1997). Although many schools had little to no resources to provide other teachers with proper training and supplies to incorporate technology in their own classroom, by the end of the sessions, 98.9% of the participating teachers felt "comfortable and confident after attending the program" (Makgato, 2014). By providing opportunities and education to teachers on using technology in curriculum, South Africa has been able to continue their development of technological education and exposure for students.

While using technology and different online programs, the socio-emotional benefit of a technological education is equally important to a student's education. By being primarily responsible and actively involved in their own education, students build a sense of autonomy as well as develop important study and work skills. With programs to teach teachers on how to

effectively use technology, the implementation of technology throughout primary education can continue to grow and inspire students.

Methods and Procedure

Through working with CalStateTEACH and various volunteering opportunities, seeing the discrepancy in technological tools throughout different schools, and the immediate need for computer science skills in professional venues, I knew I wanted my capstone project to revolve around technology and computer science education for elementary school students. I was able to narrow down my focus to computer science and coding in primary education after speaking with both Brian Van Dyck, the Director of Curriculum and Instruction of Embark Labs, and Dr. Scott Waltz, an Associate Professor in the Liberal Studies Department.

I began by contacting Mr. Van Dyck regarding Embark Labs and their educational programs for both students and educators. We spoke at length about the curriculum Embark Labs developed for their educational programs over the summer and throughout the year at the Krause Center for Innovation and the Computer Science Museum as well as what they've seen in terms of student participation and understanding of computer science, specifically coding. I then decided to attend Embark Labs' Educator Training sessions to further my understanding of computer science, coding, and how to present it to elementary aged students.

I attended two of their Educator Training sessions, on October 3rd and October 17th, where Mr. Van Dyck went through the Embark Labs' Computer Science curriculum and taught us an abridged version of their program. Through these trainings, not only did I learn basic computer science skills, such as reading binary numbers and how to code, but I also improved my communication skills and expanded my knowledge on the design thinking process. It became very clear to me that essentially computer science skills, like coding, comes down to basic computer skills and problem solving techniques. I could easily see how computer science, and Embark Labs' own curriculum, could be taught to elementary school children and how

beneficial it would be for them for multiple reasons, like improving their problem solving and interpersonal communication skills.

After completing the Educator Trainings, I wanted to either create my own computer science curriculum or manipulate the Embark Labs curriculum provided by Mr. Van Dyck. The original Embark Labs curriculum is designed for a five days a week, five week lab for students and with the time available, using the curriculum in its entirety was not a viable option. I spoke at length with Mr. Van Dyck regarding different portions of the Embark Labs curriculum and how it could be realistically altered so I could go into a computer class or after school program for implementation. He was generous enough to offer the resources and space of Embark Labs, however, their office is in Menlo Park so the geographical distance between myself and their office made it difficult to schedule a time that both students, myself, and Mr. Van Dyck could attend. Additionally, Mr. Van Dyck had little time to travel to Monterey, like previously planned, to help implement a modified curriculum. Unfortunately, due to the time and geographical constraints, I was unable to go into a classroom or after-school program to teach computer science lessons to students.

I had been continuing my research on computer science, technology, and its usage in the classroom. While there was numerous sources on technology implementation, it was difficult to find credible, detailed sources on using computer science in education, especially in primary education. Many of the sources I found specifically on computer science were either brief, new and unsupported, or focused on computer science in secondary education. I wanted to focus my research on primary education, since that was my interest and training with Embark Labs emphasised, but found I needed to focus on technology in general throughout educational practices and curriculum.

Since technology is a very broad term, it was difficult narrowing down sources and research. There were many interesting articles on how technology has been used throughout education as well as numerous educational practices for both teachers and students, but two interesting themes started to appear and interest me: how technology affects cognitive thinking in students and how using technology to supplement curriculum increases learning and retention among students. While reading and annotating these journals and other publications, I became more interested in how students in the United States, home of large, commonplace, and revolutionary technological companies such as Facebook, Dropbox, and Pandora, compare to their peers in other places in the world in terms of computer science and technology skills. I began to further research what a technological and computer science education looks like internationally and how that parallels and differs from that in the United States.

I decided to interview educators with different levels of involvement with computer science in primary education. I wanted to get different perspectives within education and how they saw computer science and technology affecting education, whether it was a positive or negative experience. To receive a balanced, overall view of technology's effect on education, I interviewed administrators and teachers, as well as students who received their education in the United States and other countries. I wanted to add their unique perspectives on computer science, technology, and education to the overall narrative of computer science in primary education.

After researching international educational practices with technology, many countries such as the United Kingdom and Australia, frequently appeared however other countries, such as South Africa and Israel, had educational practices surprised me. Before doing further research, I did not think of either as a technologically advanced country or of implementing technology

commonly in education. Since both South Africa and Israel surprised and interested me the most, I decided to do further research on both of their educational reforms.

I kept in touch with both Mr. Van Dyck and Dr. Flores throughout my research and gained other sources from them as well. Some of the sources I used through my research, such as the video "What Most Schools Don't Teach," came from their recommendation as well as the idea to specifically compare students in the United States to students internationally. Dr. Flores, when speaking with her about my research on technological supplementation, was kind enough to offer data from CalStateTEACH's Summer Literacy Labs to support my thesis. Since both Dr. Flores and Mr. Van Dyck have attended and presented at many technological education conferences, such as "Computer Using Educators" and "Mobile Technology in Initial Teacher Education" conferences, they had many beneficial suggestions of organizations, sources, or topics to look at further.

Even though I was unable to implement or introduce a curriculum to students, I will be continuing my own computer science education and implementation in the classroom. In January, I will begin student teaching at the Big Sur Charter School in Monterey where part of my assignment will be working with 4-6th grade students on their technology skills and potentially using Embark Labs' curriculum to do a specific computer science lesson. Additionally, I will be continuing to work with Embark Labs June and July of 2016 for their new program they will be offering for the Salinas City Unified School District as a teacher trainer for teaching candidates before participating in the program. I will also be working directly with students when the program begins and teaching the computer science and coding curriculum.

Conclusion

Technology can be used throughout education in various ways. From assistive devices and programs for students with disabilities to actively engaging a student in their own learning, when used properly technological devices and applications strongly supports learning and retention.

Using technology in classrooms incorporates both vertical and lateral thinking, which allows students to problem solve more creatively and make more connections between what they are learning and real world applications. Additionally, using technology to supplement lessons within the classroom help students connect and retain information. Technological programs that are designed to provide students with direct instruction assist the teacher that may not have time within the normal school hours to help those students as well as providing specific lessons or support for students.

Along with the academic benefits of using technology, students in classrooms that incorporate technology within the curriculum benefit from socio-emotional growth as well. Students become more autonomous using technological devices and programs throughout their education because their participation is mandatory yet can be provided in multiple mediums. With a student-driven education with technology, students not only learn necessary technology skills but become practice responsibility and study skills that carry onto their future education and careers.

Although I had anticipated implementing a technological based curriculum within a classroom or after-school program, I feel more knowledgeable about using technology in education and comfortable implementing technological devices or programs within a curriculum.

I am eager to continue my computer science education and begin using technology within my own classroom.

References

Assistive Technology: Resource Roundup. (2015, October 26). Retrieved November 12, 2015, from http://www.edutopia.org/article/assistive-technology-resources

Barranti, D. (2015, November 3). Computer Science in Education [E-mail interview].

Carey, L. (2015, November 10). Computer Science and Technology in Education [E-mail interview].

CalStateTEACH. (2015). *Summer Lab Schools Literacy Data.* [data set].

Chilcott, L. (Director). (2013). What Most Schools Don't Teach [Motion picture]. Code.org. https://www.youtube.com/watch?v=nKIu9yen5nc

Cruz-Uribe, E. (2013). Human Nature. Lecture presented at Global History, Seaside.

Davis, V. (2013, December 4). 15 Ways of Teaching Every Student to Code (Even Without a Computer). Retrieved September 30, 2015.

Educational Technology and Change. (2010). TechTrends: Linking Research & Practice to Improve Learning, 54(5), 6-7. doi:10.1007/s11528-010-0424-1

El Gabilan Elementary School. (2014). Retrieved November 13, 2015, from http://school-ratings.com/school_details/27661426026520.html

Embark Labs | Computer Science for K12. (n.d.). Retrieved September 24, 2015.

Flores, A. (2015, November 2). Computer Science in Education [Personal interview].

Gluga, R., Kay, J., Lister, R., & Kleitman, S. (2013). Mastering cognitive development theory in computer science education. *Computer Science Education, 23*(1), 24-57.

Halleck, T. (2015, January 30). Facebook: One Out Of Every Five People On Earth Have An Active Account. Retrieved November 12, 2015, from http://www.ibtimes.com/facebook-one-out-every-five-people-earth-have-active-account-1801240

Hepworth, A. (2015, November 11). Computer Science and Technology in Education [E-mail interview].

History of Computers in Education. (2008). Retrieved November 12, 2015, from http://web.csulb.edu/~murdock/histofcs.html

Johnson, B. (2013, August 22). Back to School: Differentiation for All Students. Retrieved September 30, 2015, from http://www.edutopia.org/blog/BTS-differentiation-for-all-students-ben-johnson

Journal of Educational Media, Vol. 27, No. 3, 2002 Digital Media and Education: cognitive impact of information visualization UTE KRAIDY Washington DC, USA

Liberal Studies. (n.d.). Retrieved September 28, 2015.

Makgato, M. (2014). The Challenges of Teaching and Learning Technology Subject at Schools in South Africa: A Case of INSET Teachers in Mpumalanga Province. 5th World Conference on Educational Sciences, 116(21), 3688–3692-3688–3692.

Means, B. (2010). Technology and Education Change: Focus on Student Learning. Journal Of Research On Technology In Education (International Society For Technology In Education), 42(3), 285-307.

Raskind, M., & Higgins, E. (1998). Assistive technology for postsecondary students with learning disabilities: an overview. Journal Of Learning Disabilities, 31(1), 27-40.

Salomons, A. , & Goos, M. (2014). A review of "occupational change in europe: How technology and education transform the job structure".Industrial & Labor Relations Review, 67(3), 1050.

Spears, F. (2015, October 21). "Education Vertical" Lecture presented at GITEX 2015 in Dubai World Trade Center, Dubai.

The Israeli Economy Today. (n.d.). http://embassies.gov.il/san-francisco/AboutIsrael/Economy/Pages/The-Israeli-Economy-Today.aspx

Van Dyck, B. (2015, October 3). Computer Science. Lecture presented at Teacher Training in MeU, Menlo Park.

Waks, S. (1997). Lateral Thinking and Technology Education.Journal of Science Education and Technology, 6(4), 245-255. Retrieved from JSTOR.

Appendices

Embark Labs NDA- Training Sessions 2015

ONE-WAY NON-DISCLSOURE AGREEMENT (NDA)

This Non-Disclosure Agreement, dated as of October 1, 2015 (the "Effective Date") governs the disclosure of information by Embark Labs, Inc. (the "Company") to Training Session attendee (the "Recipient") for the purpose of supporting the Company's educational programs (the "Purpose").

1. **Confidential Information.** As used herein, "Confidential Information" shall mean any and all technical and non-technical information that Company provides Recipient, whether in graphic, electronic, written or oral form, and including but not limited to patent applications and other filings, trade secrets, and any other proprietary information, as well as any ideas, techniques, sketches, drawings, works of authorship, models, inventions, know-how, processes, algorithms, software programs, documents, and formulae related to the current, future, and proposed products and services of Company, and also any information concerning any research, experimental work, development, design details and specifications, engineering, financial information, purchasing, customer lists, investors, employees, business and contractual relationships, business forecasts, sales and merchandising, or marketing plans of Company and any information Company provides regarding third parties.

2. **Non-Disclosure.** Recipient agrees that at all times and notwithstanding any termination or expiration of this Agreement it will hold in strict confidence and not disclose to any third party any Confidential Information except as approved in writing in advance by Company, and will use the Confidential Information for no purpose other than the Purpose. Recipient shall only permit access to Confidential Information to those of its employees or authorized representatives having a need to know and who have signed confidentiality agreements or are otherwise bound by confidentiality obligations at least as restrictive as those contained herein.

3. **Notice of Disclosure.** Recipient shall immediately notify Company upon discovery of any loss or unauthorized disclosure of the Confidential Information.

4. **Use of Confidential Information.** All Confidential Information is provided "AS IS," without any warranty of any kind. Recipient recognizes and agrees that nothing contained in this Agreement shall be construed as granting it any property rights, by license or otherwise, to any Confidential Information, or to any invention or any patent, copyright, trademark, or other intellectual property right that has issued or that may issue, based on such Confidential Information. Recipient shall not make, have made, use or sell for any purpose any product or service or other item using, incorporating or derived from any Confidential Information, nor make any filings or registrations based on the receipt or use of the Confidential Information, absent separate written approval of Company. Recipient

agrees they will not use any of the Company's unique methodologies in any competitive context.

5. **No Reproduction.** Confidential Information shall not be reproduced in any form except as required to accomplish the intent of this Agreement. Any reproduction of any Confidential Information shall remain the property of Company and shall contain any and all confidential or proprietary notices or legends which appear on the original.

6. **Term**. This Agreement shall terminate three (3) years after the Effective Date, or may be terminated by either party at any time upon thirty (30) days written notice to the other party; provided, however, Recipient's obligations under this Agreement shall survive termination of the Agreement between the parties and shall be binding upon the Recipient's heirs, successors and assigns. Upon termination or expiration of the Agreement, or upon written request of Company, Recipient shall promptly return to the Company all documents and other tangible materials representing the Confidential Information and all copies thereof.

7. **Miscellaneous**.
    a. **Amendments and Waivers.** Any term of this Agreement may be amended or waived only with the written consent of the Company.
    b. **Sole Agreement.** The Agreement sets forth the complete, exclusive and final statement of the agreement between the parties as to the subject matter hereof and supersedes all prior and contemporaneous agreements, understandings, negotiations and discussions, whether oral or written, between the parties regarding such subject matter.
    c. **Competing Business or Programs**: Recipient is not permitted to start or run their own competing business (defined as offering the same or similar services of the Company) within three (3) years after the termination of this agreement.
    d. **Notices**. Any notice required or permitted by this Agreement shall be in writing and shall be deemed sufficient upon delivery, when delivered personally or by overnight courier or sent by email (upon customary confirmation of receipt), or forty-eight (48) hours after being deposited in the U.S. mail as certified or registered mail with postage prepaid, addressed to the party to be notified at such party's address or fax number as set forth on the signature page or as subsequently modified by written notice.
    e. **Choice of Law.** The validity, interpretation, construction and performance of this Agreement shall be governed by the laws of the State of California, without giving effect to the principles of conflict of laws.
    f. **Severability**. If one or more provisions of this Agreement are held to be unenforceable under applicable law, the parties agree to renegotiate such provision in good faith. In the event that the parties cannot reach a mutually agreeable and enforceable replacement for such provision, then
        i. such provision shall be excluded from this Agreement
        ii. the balance of the Agreement shall be interpreted as if such provision were so excluded and

iii. the balance of the Agreement shall be enforceable in accordance with its terms.

g. **Counterparts**. This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together will constitute one and the same instrument.

h. **Assignment**. Recipient will not assign or transfer any rights or obligations under this Agreement without the prior written consent of Company. Any such assignment without prior consent shall be null and void from the beginning. Recipient shall not export, directly or indirectly, any technical data acquired from Company pursuant to this Agreement or any product utilizing any such data to any country for which the U.S. Government or any agency thereof at the time of export requires an export license or other governmental approval without first obtaining such license or approval.

i. **Dispute Resolution.** Recipient agrees that upon Company's request, all disputes arising hereunder shall be adjudicated in the state and federal courts having jurisdiction over disputes arising in Santa Clara County, CA and Recipient hereby agrees to consent to the personal jurisdiction of such courts.

j. **Advice of Counsel.** EACH PARTY ACKNOWLEDGES THAT, IN EXECUTING THIS AGREEMENT, SUCH PARTY HAS HAD THE OPPORTUNITY TO SEEK THE ADVICE OF INDEPENDENT LEGAL COUNSEL, AND HAS READ AND UNDERSTOOD ALL OF THE TERMS AND PROVISIONS OF THIS AGREEMENT. THIS AGREEMENT SHALL NOT BE CONSTRUED AGAINST ANY PARTY BY REASON OF THE DRAFTING OR PREPARATION

In Witness Whereof, the parties hereto have caused this Non-Disclosure Agreement to be executed as of the Effective Date.

Embark Labs, Inc.

By: Jessie Arora

Title: Founder/CEO, Embark Labs

Date: October 1, 2015

Training Session Attendee

Recipient Name: Kathryn Holt

Signature: Kathryn Holt

Date: 10/3/15

PERMISSION TO USE COPYRIGHTED WORKS IN A PUBLICATION

October 11th, 2015

Dr. Alice Flores
100 Campus Center Dr.
Bld. 201, Ste. 201
Seaside, CA, 93955

Dear Dr. Flores,

I am a student at California State University, Monterey Bay. I am in the process of preparing a research presentation for the class Liberal Studies 400: Senior Capstone and am seeking permission to include the Raz-Kids research data from the 2015 CalStateTEACH Summer Literacy Labs conducted at both the Oakland Pride School and El Gabilan Elementary School for the Kindergarten and fifth grade class respectively. This includes the pre- and post- data information on the fluency and accuracy of each student as well as the grade averages. For confidentiality, the names and specific scores of each student participant will not be used.

The work will be used in correlation with personal research and information to support the thesis that the usage of technology in primary education is beneficial for students. I would like to use the overall improvement of students' reading fluency and accuracy through using Raz-Kids as an example of one successful way technology has been used to further supplement educational instruction.

Please let me know if there is a fee for using this work in this manner.

Please indicate your approval of this request by signing the letter where indicated below and returning it to me as soon as possible using the self-addressed envelope. Your signing of this letter will also confirm that you own the copyright to the above-described material. Additionally, this information provided will be used solely for this presentation and will not be further published or used.

Sincerely,

Kathryn Holt

kholt@csumb.edu

For copyright owner use:

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

By: Dr. Alice Flores

Title: Regional Director, CalStateTEACH

Date: October 15th, 2015

Signature:

11/11/15

Interview: Adam Hepworth

1. **What is your current level of education?**
    - *Bachelor of Science in Mathematics, minoring in Electrical Engineering and Computer Science (University of New South Wales, graduated 2009)*
    - *Master of Logistics and Supply Chain Management (University of South Australia, graduated 2015)*
    - *Master of Science in Operations Research (Naval Postgraduate School, currently undertaking studies)*

2. **How would you describe computer science?**
    - *Computer Science is an applied approach to solving computational problems through the use of algorithms within programming languages to achieve a meaningful and usable output, from the transformation of various inputs.*

3. **How do you use computer science skills today in your current education?**
    - *On a daily basis I program in many languages to solve simple through to complex problems: from mathematical modelling (GAMS and R) to general purpose programming languages (Java, JavaScript and Python), enhancing the framing of problems and reducing the manual computation required to produce tangible outputs.*

4. **How do you use technology in your current education?**
    - *I use various tech platforms to assist in the framing and solution of problems, as well as facilitate rapid decision making. These include:*
        - *BlackBerry smart phone – communication and administration; basic research*
        - *iPad – simple computational problems; communication and administration; basic research*
        - *Windows-based computer – specific programming applications; advanced research; communication and administration*
        - *Mac-based computer – specific programming applications; advanced research; communication and administration*
        - *Linux-based computer time-share cluster – advanced computational activities; resource intensive optimisation and data analysis programs*

5. **How do you use technology in your daily life?**
    - *As above*

6. **How would you describe your overall primary educational experience?**
    - *High science and problem solving focus with a considerable number of experiments to reinforce basic physical science theory learnt within school. A large focus was placed on the ability to read and write above the national average, apply and understand elementary physical science and mathematical skills, as well as participate in health/physical education and some aspect of the arts (such as music, dancing etc).*
    - *Note: The primary education system in Australia finishes in Year 6. For me, this was in the year 2000, beginning high school in 2001.*

7. **What technology, if any, did you use in your primary education?**
    - *I was taught to use both Apple and Windows based computers for presentations (such as MS PowerPoint), elementary data manipulation (conducting a practical example of elementary math skills such as finding averages, working with the concept of sets and max/min etc). The use of games was also done to teach interaction with peripherals and I/O devices, as well as how to conduct simple fault-finding on personal computers.*

8. **Did you receive any education on computer science, formal or informal? If so, what did you learn?**
    - *Primary School – As above*
    - *High School (Year 7-10) – Touch typing, using information systems as a resource for research etc.*
    - *College (Year 11/12) – Programming classes in JavaScript, developing elementary programming skills; information system classes focusing on basic computer network architecture and information processing.*
    - *University (Undergraduate - UNSW) – Development from elementary skills through to more advanced concepts such as recursion, working with large data set arrays and other data structures, and facilitating both local and global network construction and administration*
    - *University (Graduate, UniSA) – applied use of optimisation and network theory to solve supply chain and financial problems*
    - *University (Graduate, NPS) – full spectrum programming from simple I/O scripts through to cluster based commercial network, data analysis and optimisation programs running over many days or weeks to solve very complex computational problems.*

9. **Do you think using technology in the classroom changed how you learned? If so, how?**

- *Absolutely! The use of tech from an early age enhances interest in the STEM fields and provides a great basis for students to research interest areas and gain a wide breadth of understanding of how "the world works". Without the use of tech, students are limited in their sources of information and can be blindly educated based on a system-bias agenda, as opposed to an open system which supports interest-based learning methods and facilitates students learning through the education system.*

10. Do you see your interaction with technology and/or computer science in primary school beneficial? (How has it helped/hindered you?)

- *Yes. Developing elementary skills as a child and having the ability to move beyond the scope of the education framework and learning outcomes means that students are comfortable at each education milestone in applying skills. Bridging the gap between each significant level of education change (ie primary to high, high to college, college to university) is key to set students up for success in their journey through the system: introducing the skills required at an early level in order have some familiarity with them prior to learning and testing at future times.*

11/2/15

Interview: Dr. Alice Flores

1. **What is your position within education?**
    - *Director of CalStateTEACH a M.S. program that has an online delivery*

2. **How long have you been involved in education?**
    - *45 years*

3. **How have you seen technology use change in education?**
    - *Technology has dramatically changed from the 1970's where there was one computer in one room and it took 24 hours to get information back to now where there's a handheld device where you can access data immediate.*

4. **How have you seen technology change education?**
    - *We went from writing our own program using FORTRAN and COBAL to the most current programs in learning how to code which can be used by a five year old.*

5. **How have you seen technology change or shape the learning process among students?**
    - *Students have gone from being receivers to initiators.*

6. **Does the lack of technology in some schools affect a student's overall education?**
    - *The lack of technology has adverse effects on students who are not making adequate progress in learning how to use and relate to modern society, via the world wide web. Access to information readily.*

7. **Do you think using technology in the classroom changes how students interact with teachers?**
    - *Yes, students become information filters and they have more autonomy about how they learn and how they put information together.*

8. **How important is it for teachers to understand how to effectively use technology in their own classrooms?**
    - *It is very important that teachers be able to integrate other technological skills into their content throughout the day and it should not be one time only but continuous use of technology to supplement the curriculum and instructional process.*

9. **How do you think computer science and technology skills should be taught?**
    - *I think it can be taught in a number of ways and not just in one way. It could be taught with PBL, it could be taught with demonstration, it could be taught with direct instruction and it should also allow students to self teach.*

10. Who should teach computer science and technology schools in classrooms?

- *I think they should be taught by many different teachers in many different content areas and there are fundamental skills that all teachers can use to teach introductory skills in technology.*

11/3/15

Interview: Dr. Judy Barranti:

1. **What has been your experience/interactions with computer science in education?**

    - *My interest in computer science for students began when I was earning my Master's degree at San Jose State. I wrote my dissertation about the effectiveness of the first computer lab in Santa Clara County. It was a mobile lab sponsored by the Santa Clara County Office of Education.*
    - *My dissertation convinced me that an occasional visit to a mobile computer lab would not be sufficient to enable students to use computers as educational tools. As a principal I was the first in my district to organize a computer lab with donated computers. Students used the lab primarily for word processing.*
    - *As an assistant superintendent in a unified school district I inaugurated and then supported a middle school to begin a program with students bringing and using their own computers to support all core curriculum. I bargained an agreement with IBM, attended their advanced educational leaders institute in New York and helped to develop the curriculum for the school. I also initiated the district's first computerized report cards for all 10,000 students.*

2. **What grade are your grandchildren in and what is their experience with computer science?**
    - *My grandson is 12 years old. My granddaughter is 11 years old. They are both tested as gifted. My grandson is also diagnosed with severe ADHD. Their first experiences with technology was on hand held computer playing games. They have had many types of gaming platforms. They have owned their own iPods for many years. They received their own iPads soon after the initial release of iPads and now both also have their own iPhones and iMacBook Airs. They use their technology for school and personal interests.*

3. **How have you seen their education of computer science affect them within the classroom?**
    - *The middle school where both students attend use computers with the classroom and in a computer lab. They use the computers for testing, word processing, research, practice, reports, and presentations. They do not have instruction in the use of computers or coding.*

4. **Have you seen if/how their computer science education affect them socially with their peers in the classroom?**

    - *Not aware of this.*

5. **Do you see any benefits in a computer science education?**

    - *Absolutely. It is the way of the future for our students.*

11/11/15

Interview: Håvard Rosenlund

1. **What level of education are you currently in?**

   I am currently in my third year of law school. A five year long integrated masters degree.

2. **How would you describe computer science?**

   The answer would depend of witch level of education the subject of interview is in. For my part it would be described as the knowledge upon how to make computers work with our modern society. In more specific means a student would have to gain knowledge of how the computer works. Then the use of computers for scientific purposes most be researched, in order to have it proper integrated to the public use. This is a way to make faster progress in both science as a study and the general population.

3. **How do you use computer science skills today in your current education?**

   In the study of law we are dependent upon sources. Every legal question much be answered through law. The legal sources for solving a legal question can be many. Having access to these sources is crucial in order to interpretate your way towards a rule. Here is manly where the use of computer science skills comes into action. In our modern society there are more and more sources available for solving a legal question. There is no point in collecting all the legal sources if the jurist is unable to find the relevant material for the legal question.
   This is why law-students needs to be able to use computers and the codes connected to isolate every legal source relevant for the question.
   Another important computer science skill is Internet based sources for handing in papers. Today most of our exams are to be written on an internet address, limited to one router and then handed in to the faculty.

4. **How do you use technology in your current education?**

   I mainly use technology for legal research, taking notes, writing papers and exams.

5. **How do you use technology in your daily life?**

   First off is my iPhone. I use it every day for anything from text-messages to checking my e-mail. Also I have several accounts online for banks, social medias and rental contracts. Finally there is entertainment like Netflix and HBO-nordic.

6. **How would you describe your overall primary educational experience?**

   I went to primary school when the public started to have some limited access to computers. Mostly we would read from books. Take notes on paper and then memorize what seemed to be important. No one had full access to computers before 6th or 7th grade and it did not become "normal" until high school for students to have their own computer. We did everything manually until 8th grade.

7. **What technology, if any, did you use in your primary education?**

   It started with standard computers, windows software. We were sometimes able to get access to a "computer room" where we wrote in "word" and had some access to an Internet browser. This was limited to once or twice a week, starting from 4th or 5th grade.

8. **Did you receive any education on computer science, formal or informal? If so, what did you learn?**

   We were taught how to go from writing on papers and memorizing "important phrases" in schoolbooks, to finding the same information online. This has become the standard norm. There is very little focus upon memorizing material and much more focus upon using technology for research.
   So basically the school taught us how to use computer science for research.

9. **Do you think using technology in the classroom changed how you learned? If so, how?**

   I have very little doubt that technology has changed the way we learn. I would say that knowledge is much easier to obtain now, than before computers became the standard research tool. However I believe that is has made us lazy. It is much easier to cheat with the modern technology. It is easier to put work on hold, waiting until the last minute before finishing an assignment. On the other hand we have access to unlimited amount of information. This has made it harder to achieve good grades, because students are expected to tell apart the relevant sources of information, from the irrelevant.

10. **Do you see your interaction with technology and/or computer science in primary school beneficial? (How has it helped/hindered you?)**

    The way we started to gain knowledge through technology early in primary school has made it easier to adapt once our studies became more complex. In my opinion we are

more prepared now, than before to cross over from general education, to more selective and complex studies in universities.

11/10/15

Interview: Lora Carey

1. **What is your position within education?**
    - *I am a 5th grade teacher in a Title I School*

2. **How long have you been involved in education?**
    - *I have been a teacher for 2 years. However, I also worked for CalStateTEACH for 3 years.*

3. **How have you seen technology use change in education?**
    - *Technology went from a place that you visited like a computer lab or a few computers in a classroom (although that is still true for some school) to being able to have instant access to information through 1:1 devices. In some cases textbooks are secondary to researching online. Projects that used to take materials can now be accomplished virtually.*

4. **How have you seen technology change education?**
    - *My students have more control over the learning process. I am not the purveyor of information; the students are the master of their own knowledge. We can make dynamic projects and engage in real world learning that can be shared with a global audience. Students can make videos explaining their thinking and share them with others. We can do newscasts to present our research on natural disasters. We can illustrate and animate our reading summaries. Our learning is no longer static. I can get instant feedback. I can check for understanding and students think that they are playing a game.*

5. **How have you seen technology change or shape the learning process among students?**
    - *There is a sense of excitement. Students can feed their curiosity about subjects. It provides instant feedback and gratification of what they want to know. I get instant feedback and can shape instruction. The learning process also becomes more tailored because there is more freedom.*

6. **Does the lack of technology in some schools affect a student's overall education?**
    - *I think that students are less likely to see the internet or devices as a learning tool instead of an entertainment and social media device.*

7. **Do you think using technology in the classroom changes how students interact with each other? Between students and teachers?**
    - *I am more accessible to students as they can text me or comment in our online classroom. Students are able to help each other as one student posts a question, another student may answer before I can respond. Students have to think about the consequences of their actions because of the amount of technology not just in the physical handling of technology but also the development of a positive digital*

footprint. Digital Citizenship is linked to classroom citizenship and creating a positive environment for students online and in the classroom. Student interaction is pretty much the same; they will still have off topic conversations and interact with each other in the classroom. However, they will also have off topic conversations and interact with each other in our online classroom.

8. **How does teaching computer science enhance or detract from other areas of study in the classroom?**
    - *It enhances other areas because it can be integrated into other subject matter like history, language arts (grammar and syntax), math (geometry, patterns, base 2, etc)*

9. **What, if any, other skills do students learn from computer science lessons?**
    - *Logic, sequential thinking, practical application of mathematics and scientific principles.*

10. **Do you see any benefits in a computer science education beyond the classroom? If so, what do you think they are?**
    - *Future career readiness, sequential thinking, recognizing patterns and logic are all skills that will help students beyond the classroom setting.*