

**INCREASING TECHNOLOGICAL LITERACY OF SPECIAL EDUCATION
STUDENTS AT SUNNY HIGH**

by

Joseph A. Fragale Jr.

An executive position paper submitted to the Faculty of the University of Delaware in
partial fulfillment of the requirements for the degree of Doctor of Education in
Educational Leadership.

Fall 2017

© 2017 Joseph A. Fragale Jr.
All Rights Reserved

**INCREASING TECHNOLOGICAL LITERACY OF SPECIAL EDUCATION
STUDENTS AT SUNNY HIGH**

by

Joseph A. Fragale, Jr.

Approved: _____
Chrystalla Mouza, Ed.D.
Interim Director of the School of Education

Approved: _____
Carol Vukelich, Ph.D.
Dean of the College of Education and Human
Development

Approved: _____
Ann Ardis, Ph.D.
Senior Vice Provost for Graduate and Professional Education

I certify that I have read this executive position paper and that in my opinion it meets the academic and professional standard required by the University of Delaware as an executive position paper for the degree of Doctor of Education.

Signed:

Chrystalla Mouza, Ed.D.
Professor in charge of the executive position paper

I certify that I have read this executive position paper and that in my opinion it meets the academic and professional standard required by the University of Delaware as an executive position paper for the degree of Doctor of Education.

Signed:

Fred T. Hofstetter, Ph.D.
Member of the executive position paper committee

I certify that I have read this executive position paper and that in my opinion it meets the academic and professional standard required by the University of Delaware as an executive position paper for the degree of Doctor of Education.

Signed:

Laura Eisenman, Ph.D.
Member of the executive position paper committee

I certify that I have read this executive position paper and that in my opinion it meets the academic and professional standard required by the University of Delaware as an executive position paper for the degree of Doctor of Education.

Signed:

Amy Haughey, M.Ed.
Member of the executive position paper committee

ACKNOWLEDGMENTS

Thank you Dr. Mouza for your patience; I appreciate it truly. Thank you Jess for getting me started on this. I miss you daily. Thank you Lorraine for editing my paper; I think I now know how to use commas properly. I'd like to dedicate this work to Jennie Maslow. You saved me. Thank you.

TABLE OF CONTENTS

LIST OF TABLES	vii
DEFINITION OF KEY TERMS AND ACRONYMS	ix
ABSTRACT	x
Chapter	
1 THE IMPORTANCE OF TECHNOLOGICAL LITERACY	1
Organization of the Executive Position Paper	1
Statement of the Problem	1
Literature Review	5
Definition of Technological Literacy	6
Instructional Strategies for Developing Student Technological Literacy	8
Barriers to Developing Technological Literacy for Special Education Students	11
<i>Technology barriers.</i>	11
<i>Teacher knowledge barriers.</i>	11
Key Questions	15
2 METHODS	17
Data Collection	17
Participants	24
Findings	28
3 RECOMMENDATIONS	43
Recommendation 1: Align the multimedia pathway with the Delaware and ISTE standards	43
Recommendation 2: Provide students with meaningful technology experiences	46
Recommendation 3: Support students as creators of technology through coding	50
Recommendation 4: Teachers should differentiate lessons, content and learning experiences	56

REFERENCES.....62

Appendix

A IRB CERTIFICATE.....67
B RECRUITMENT EMAIL.....68
C INFORMED CONSENT FORM.....69

LIST OF TABLES

Table 1: Interview Protocol.....	20
Table 2: Coding Scheme.....	24
Table 3: Participants.....	27
Table 4: Technologies Recommended.....	33
Table 5: Technological Literacy Skills.....	36

LIST OF FIGURES

Figure 1: Universal Design for Learning.....	15
Figure 2: Kahoot.....	40
Figure 3: Canva.com.....	45
Figure 4: Teachertube.com.....	47
Figure 5:Codeacademy.com.....	51
Figure 6: Codeacademy.com HTML Lesson.....	52
Figure 7: Tynker.com.....	53
Figure 8: Tynker.com Code Lesson.....	54
Figure 9: Code.org.....	55
Figure 10: Code.org Teacher Guide.....	55
Figure 11: Universal Design for Learning.....	57

DEFINITION OF KEY TERMS AND ACRONYMS

Differentiated Instruction- A framework for teaching and learning where students are offered different avenues of instruction so that they have multiple means to acquire and learn new information and skills

Educational Technology- Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources.

ESSA- Every Student Succeeds Act federal policy established in 2015

ICT-Information and Communication Technology

ITEEA-International Technology and Engineering Educators Association

NCLB-No Child Left Behind

STEM-Science, Technology, Engineering, and Mathematics

TPACK- Technological Pedagogical Content Knowledge

Technology- The innovation, change, or modification of the natural environment in order to satisfy perceived human wants or needs

Technological Literacy-The ability to use, manage, evaluate, and understand technology

Universal Design for Learning-a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn.

ABSTRACT

The purpose of this Executive Position Paper (EPP) is to use the literature and data collected from interviews with professionals in the field of technology and special education to provide recommendations for improving the multimedia pathway at Sunny High School so that it supports the students' development of their technological literacy. Twelve professionals from the fields of technology and special education were interviewed. A semi structured interview protocol was used to collect qualitative data. The questions for the interview were developed from the literature and the key questions guiding this EPP. The interviews were tape recorded and transcribed. The participants were given pseudonyms, and all identifying data were destroyed including interview tapes. Once the data were transcribed, they were coded using a system derived from the literature and the guiding questions of the EPP. To ensure accuracy, the data were then coded by another rater to ensure interrater reliability. Four major recommendations are made to improve the multimedia pathway. First, Delaware technology standards should guide the multimedia pathway. Second, students should be exposed to meaningful experiences with technology. Third, coding should be taught as a skill to the students in the multimedia pathway. Finally, it is recommended that Universal Design for Learning be used in the pathway to give students various ways to learn and show what they have learned.

Chapter 1

THE IMPORTANCE OF TECHNOLOGICAL LITERACY

Organization of the Executive Position Paper

This paper is organized into three chapters. Chapter 1 contains the statement of the problem and literature review. The chapter establishes the purpose of this Executive Position Paper (EPP), its goals, and the literature used to formulate the foundational knowledge on which the paper is built.

Chapter 2 reports on the methodology used to design the project and the guiding questions that drove the investigation. In particular, the chapter describes the participants and data collection technique. It also provides an overview of the data analysis process to further the readers' understanding of the findings. Finally, this chapter presents the findings of this examination organized around the four key questions that drove the investigation.

The third and final chapter includes recommendations by the author that emerged from the findings. Limitations and risks associated with the project are also discussed. This chapter ends with the conclusion.

Statement of the Problem

The special education students entering the Sunny High School Multimedia Pathway are not technologically literate. The Every Child Succeeds Act (ESSA) of 2015 creates federal policies that “support new teaching and learning that focuses on students as active participants with edtech tools and strategies to enhance deeper learning, including through effective communication and collaboration” (Mesecar, 2016). The students who take the multimedia pathway have either been referred to the

multimedia pathway by their teachers, who have observed that they face challenges when working with technology, or the students chose the pathway themselves as a means of improving their own technological literacy. A teacher's recommendation for placement in this program is reviewed by a team of professionals. This team includes the high school's educational diagnostician, the referring school's educational diagnostician, and the student's guidance counselor and parents.

Sunny High is a pseudonym used for a public high school in Kent County, Delaware. For the 2016-2017 school year, enrollment was approximately 1,400, 17% of whom were special education students. There are 8 schools in the district servicing approximately 5,000 students. Sunny High is the only high school in the district (Department of Education Annual Snapshot, 2017).

There are 344 teachers in the district with 60% who have obtained a master's degree. Of the students, 28% are low income with 60% being white and 26% being African American. Only 1% of students were classified as English Language Learners in 2016-2017 (Department of Education Annual Snapshot, 2017).

Of the 56 students in the multimedia pathway at Sunny High during the 2016/2017 school year, 23 were freshmen and were enrolled in the first course in the multimedia pathway. All 23 students took the Delaware Department of Education Skilled and Technical Sciences pre- and posttests; the students in the other courses did not. The purpose of this assessment is to show students' academic growth. The data are used as a component of the teachers' Delaware Performance Appraisal System (DPAS) scores for the purpose of teacher evaluation.

The pretest was administered in September 2016, and the posttest was administered in May 2017. The DPAS pre- and posttests ask an array of questions

about technology and technological literacy. One question addresses the various parts of a camera aperture and how it can be adjusted. Another question asks the students how to find relevant information that is creditable. The diversity of these questions is problematic since they do not all determine whether a student is technologically literate and may ask for overly specific technological knowledge that cannot be applied outside of a specific technology.

None of the freshmen scored higher than 60% on the pretest in fall of 2016. Only 11 of these same freshmen scored 60% or greater on the posttest. This finding indicates that although there was growth, more than half of the students continued to score below 60%. Further, the findings point to the need for revising the multimedia pathway at Sunny High School to better address students' needs and prepare them to become technologically literate by the end of the pathway.

Elementary students are getting, on average, only between 10 and 60 minutes of access to information technology at school each week. The instructional time provided for information technology at school is typically inadequate for helping students become competent lifelong technology users (Hackbarth, 2004). From January to March 2014, the United States Department of Education conducted a test of 21,500 eighth graders to assess their technological literacy and engineering skills. Results indicated that only 43% of the eighth graders tested were found to be proficient in technology (Kavilanz, 2016).

I have been the teacher of the multimedia pathway since 2012 and I am also the researcher for this EPP. Hence, I am personally invested in improving the pathway so that it supports student's development of technological literacy. When I became the teacher of the pathway in 2012, it had a very limited curriculum with an out-of-date

textbook published in 2006. This textbook was covered during the first level of the multimedia pathway. Hence, for levels 2-4, there was no textbook. The goal of the pathway was described as a place for special education students to work with technology; however, there were no specifications as to why they were working with technology or even what technologies they were to work with.

The current multimedia pathway at Sunny High School serves special-education students in Grades 9-12 exclusively. Non-special-education students are allowed to take the pathway, but in the 5 years I have been the teacher, this has not occurred. This may be due to the fact that before it became a pathway, it was a multimedia course for special education students only. This classification may have created a perception among the non-special education students that this was not a pathway they wanted to take since they are not special education students.

A pathway differs from a course in that a pathway is completed over several years and is intended to help students advance through higher education and employment via the skills that they develop over the course of completing the pathway. Pathways offer more depth to learning by aligning the curriculum over multiple years to allow students to explore the skills and knowledge offered in the pathway in more than just a one-year or one-semester course.

The multimedia pathway is offered in three levels, each for the length of a school year in 90-minute blocks. There is also a Level 4 independent study in which seniors who have completed the first three levels of the pathway can continue the program and explore topics related to their interest with approval and guidance from the instructor.

All students enrolled in the multimedia pathway have Individualized Education

Programs (IEPs) and have been diagnosed with an array of disabilities, including learning disabilities, health impairments, or physical disabilities. There were 56 students enrolled in this pathway in the 2016/2017 school year, divided into four sections. The enrollment for the 2017/2018 school year should be approximately the same or slightly higher.

Currently, too few students who complete the multimedia pathway are technologically literate. This is known because of the standardized test that they take at the beginning of the year and at the end of the year. Too few students show proficiency on the test. It is also known because of anecdotal evidence from teachers who teach these students outside of the pathway.

The purpose of this EPP is to utilize the literature and data collected from interviews with professionals in the field of technology and special education to create recommendations for revising the multimedia pathway at Sunny High School. The overall objective is to support the development of technological literacy among special education students. Qualitative analysis of interview data was used to determine primary themes that were subsequently used to generate recommendations for the multimedia pathway.

Literature Review

The purpose of this review is to analyze available literature regarding students with disabilities and barriers to their acquisition of technological literacy. The literature has been used to create the EPP's key questions. The literature has been synthesized to clarify what it means to be technologically literate and why it is essential. A definition is presented for the term *technology* that is in line with how it is used in research but not necessarily in the general population. Finally, barriers are

examined that may prevent special education students from becoming technologically literate.

Definition of Technological Literacy

The International Technology and Engineering Educators Association's (ITEEA) Standards for Technological Literacy: Content for the Study of Technology defines technology as “the innovation, change, or modification of the natural environment in order to satisfy perceived human wants and needs” (*Standards for Technological Literacy*, 2007, p. 242). Within the context of the literature, it is important to note that technology does not mean only computers or computer applications exclusively, often the misconception of the general populace. Technology as defined in the literature is a tool used to affect one's environment to achieve a goal, want, or need (*Technological Literacy for All*, 2006).

ITEEA defined technological literacy as the ability to use, manage, evaluate, and understand technology. This means that technological literacy is not exclusively computer literacy but is a view of technology in which individuals have broad views of the technology, its uses, and the consequences of using technology (*Technological Literacy for All*, 2006). This relates back to the idea that technology is a tool used to achieve a goal or want. A technologically literate person is a technological problem solver who views problems from a variety of viewpoints. Technology literacy is not the same thing as educational technology, which refers to the materials used to further instruction, such as interactive whiteboards (*Technological Literacy for All*, 2006).

According to ITEEA (2015), students need to be technologically literate because the 21st century is a world influenced by technology. In fact, being technologically literate is essential to becoming a contributing and informed citizen in

the 21st century, as workplace collaboration and communication depend on technology (Crockett, 2015; ITEA, 2003). Because we live in the digital age of smartphones and constant Internet connectivity, those who cannot interact with technology are effectively left out of many social and professional experiences.

According to the International Society for Technology in Education (ISTE, 2008), technological literacy is the ability to use appropriate technology responsibly to communicate, solve problems, and access, manage, integrate, evaluate, design, and create information to improve learning in all subject areas. ISTE offers National Educational Technology (NETS) standards for students, educators, and administrators. These standards address technology as a creative tool that allows for communication and collaboration that empowers learners and prepares them for the future (ISTE, 2017).

Similarly, the state of Delaware defines technological literacy as the ability to use, manage, understand, and assess technology (Delaware Technology Definitions, 2007). The state of Delaware has adopted the ISTE standards as a way to inform efforts to promote technological literacy among students. In particular, the state of Delaware standard dictates, “In accordance with 14 Del.C. §1205(b), the NETS© are hereby incorporated by reference and adopted as Delaware's Educational Technology Standards. NETS© shall serve as the foundation for professional development, instructional practice or leadership, for all Delaware educators, and as indicators that guide the learning, teaching, and leading with technology in education. The standards make explicit the skills and knowledge needed in an increasingly connected global and digital society” (Delaware State Technological Standards, 2007).

Although technological literacy is a key component of school curricula, special

education students often lag behind their nondisabled peers (Saxena, 2014). The purpose of the multimedia pathway is to bridge the gap in technological literacy between special education students and their nondisabled peers. Having a fully formed understanding of what it means to be technologically literate is essential for the educator and for the students as well. The educator in the class must know what it means to be technologically literate in order to assess where the students are in their development. The students must know what it means to be technologically literate so they can assess their own strengths and weaknesses. Knowing their own competencies will help them to make proper career decisions in the future.

Being technologically literate means having a broad array of understanding of the many tools available to achieve a goal. Students who enter the media pathway are often not aware of the various ways technology can help them reach a goal. If they enter the workforce and society with a limited understanding of the tools available to them, they are limited in their ability to interact with and advance in the workforce and in society.

The group Partnership for 21st Century Learning has compiled and developed a list of skills needed in the 21st century. Those skills are life and career skills, key subjects (i.e. math, reading), information and media skills, technology skills and learning and information skills (Framework for 21st Century Learning, 2017).

Instructional Strategies for Developing Student Technological Literacy

The U.S. Department of Education requires states to report annually the percentage of eighth graders who achieve technology literacy by the end of the school year. Hence, all schools are federally mandated to have their students become technologically literate. As a result of this mandate, as well as rapid technological

changes in our society, support from politicians, popular opinion, and communities, educational institutions have been spending millions of dollars on educational computing tools (Ficklen & Muscara, 2001). However, access to technology does not mean that it is being used in appropriate ways that facilitate better instruction or technological literacy for students (Keengwe, Onchwari, & Wachira, 2008).

The defining characteristic of the 21st century is widespread access to information via the Internet (Wagner, 2010). According to Lenhart, Madden, and Hitlin (2002), 87% of youths aged 12-17 are online every day. If they are not all able to interact competently with the technology, they will be shut out of these experiences. Studying technology and becoming technologically literate allows individuals to become aware of the ways that technology permits them to interact with and change their environment (*Technological Literacy for All*, 2006). Further, Chandler-Olcott and Mahar (2003) argue that the integration of technology into day-to-day school lessons and classrooms may potentially interest students in other academic areas because it allows them to interact with subject matter in new ways via technology.

Marion (2009), for instance, found that students with reading disabilities benefitted from technology-based instruction in reading with interactive elements more than their nondisabled peers. The students reported that they were more engaged and felt more capable when using the technology as part of the curriculum. An example would be a student who struggles to read about the *Titanic* but may explore the wreckage virtually via a software program.

Beyond integration, students can also benefit from becoming creators rather than simply users of technology. Coding applications, in particular, have gained increased attention in recent years because of their ability to foster technological

literacy and creativity. Through the use of code, students can invent new technological products such as programs, apps, websites, and more. A 2013 study by Resnick (2013) at the Massachusetts Institute of Technology determined that students who studied code learned other skills that transferred to other areas. These skills included math concepts such as variables, problem solving skills, and the ability to work with others collaboratively and fix mistakes pointed out by others.

Students acquire their technological literacy in two ways: informally through friends and family and formally through school and work (Ezzaine, 2007). This means that although students may come into the classroom with strong informal training in technology, they may not be technologically literate unless they have had strong formal training through work or school. In fact, students who do not receive formal training in classrooms that are specifically intended to develop technological literacy will be at a disadvantage compared to those who have received formal training (*Technological Literacy for All*, 2006).

Since access and utilization of information and collaboration technologies are key features of modern life, special education students at Sunny High School who are not technologically literate are at a disadvantage. Technologically literate individuals can collaborate in social and professional environments competently. Those who cannot do these things competently will be limited in their social interactions, educational opportunities, and professional opportunities. The multimedia pathway must work to support these students in developing their technological literacy.

Special education students benefit from learning about technology because it teaches a broad array of skills such as problem solving, collaboration and logical thinking (Resnick, 2013). Special education students may be limited by their disability

in ways that they can express their intelligence. Technology allows for multiple means by which they can share what they have learned and what they are capable of (Toldi, 2016).

Barriers to Developing Technological Literacy for Special Education Students

Technology barriers. Many barriers exist that hinder students with disabilities from becoming technologically literate. Most technology introduced into schools in the past 25 years lacked features that made them usable to all students, especially those with physical, sensory, and cognitive impairments (Hitchcock, 2001). Students are inhibited from becoming technologically literate when they are not exposed to diverse technologies or made aware of what can be done with technology (Davies, 2011).

Teacher knowledge barriers. Many teachers also lack technological and pedagogical content knowledge (TPACK; Mishra & Koehler, 2006). TPACK is defined as the set of skills and knowledge that teachers need in order to integrate technology effectively into their teaching. The challenge teacher's face is learning how to teach with technology in a way that also increases their students' technological literacy (Davies, 2011). Research indicated that teachers often leave college lacking the skills necessary to teach effectively with technology (Cox, 2004). TPACK attempts to create a cohesive model that unifies and defines the various threads and brings them together. There are seven components to TPACK:

1. Technology knowledge (TK): Technology knowledge refers to knowledge about various technologies, ranging from low-tech technologies such as pencil and

paper to digital technologies such as the Internet, digital video, interactive whiteboards, and software programs.

2. Content knowledge (CK): Content knowledge is the “knowledge about actual subject matter that is to be learned or taught” (Mishra & Koehler, 2006, p. 1026). Teachers must know about the content they are going to teach and how the nature of knowledge is different for various content areas.

3. Pedagogical knowledge (PK): Pedagogical knowledge refers to the methods and processes of teaching and includes knowledge in classroom management, assessment, lesson plan development, and student learning.

4. Pedagogical content knowledge (PCK): Pedagogical content knowledge refers to the content knowledge that deals with the teaching process (Shulman, 1986). Pedagogical content knowledge is different for various content areas, as it blends both content and pedagogy with the goal being to develop better teaching practices in the content areas.

5. Technological content knowledge (TCK): Technological content knowledge refers to the knowledge of how technology can create new representations for specific content. It suggests that teachers understand that, by using a specific technology, they can change the way learners practice and understand concepts in a specific content area.

6. Technological pedagogical knowledge (TPK): Technological pedagogical knowledge refers to the knowledge of how various technologies can be used in teaching, and to understand that using technology may change the way teachers teach.

7. Technological pedagogical content knowledge (TPACK): Technological pedagogical content knowledge refers to the knowledge required by teachers for

integrating technology into their teaching in any content area. Teachers have an intuitive understanding of the complex interplay between the three basic components of knowledge (CK, PK, TK) by teaching content using appropriate pedagogical methods and technologies.

One of the barriers to special education students becoming technologically literate is that it is not known what proper technological integration looks like (Edyburn, 2001). Edyburn (2001) addressed the question, “‘What does technological integration look like and how is it achieved?’ [with] Edyburn’s Model of the Technology Integration Process.” This model describes technology integration in four phases: selection, acquisition, implementation, and integration. It seeks to create a framework within which educational professionals can create a classroom environment that successfully integrates technology so as to support the technological literacy of students. Although this model is excellent for selecting technology, it does not account for diverse learners, which includes students with disabilities. A more cohesive and appropriate model taking into account individual students’ needs is Universal Design for Learning (UDL).

UDL is a framework for addressing learner variability (*A Framework for Addressing Learner Variability*, 2016). UDL uses various means of expression, action, representation, and engagement to plan curriculum for learner variability (Cast, 2011). This means that principles and concepts are presented in various ways so as to reach learners via various modalities of learning.

Differentiated instruction is a framework for teaching and learning in which students are offered a variety of avenues of instruction so that they have multiple means to acquire and learn new information and skills (Tomlinson, 2001). UDL

differs from differentiation in that UDL presumes that the learners are diverse and builds multiple means of reaching them into the activity. Differentiation is reactive in that the teacher builds assessments then changes instruction based on the results.

Organizational Improvement Goals

The purpose of this project is to improve the Sunny High School Multimedia pathway by gathering information from professionals in the fields of educational technology and special education. The goal is to analyze this information in order to make recommendations that could improve the multimedia pathway so that students who take the program are supported in the development of their technological literacy. Being technologically literate will allow them not only to be successful in school when they use technology but will also prepare them for their future in the workplace.

Universal Design for Learning Guidelines



Figure 1. Universal Design for Learning (CAST, 2013)

Key Questions

The following key questions guided the EPP:

- What barriers to technological literacy acquisition do special education students face? This question was developed because it is the primary goal of this EPP to improve the technological literacy of the students in the multimedia pathway. Unless the barriers that they face are addressed effectively, these special education students will not become as technologically literate as their nondisabled peers.
- Which specific technologies should special education students become familiar with in the context of the multimedia pathway? This question is designed to compile a comprehensive list of specific technologies that professionals in the field recommend that special education students become competent in using. These technologies will be those that the interviewees use in their own educational programs.
- Which specific technological literacy skills should special education students acquire through the multimedia pathway? The goal of this EPP is to create an environment where special education students develop their technological literacy via the multimedia pathway. The skills that the interviewees recommend will be used to guide the program's development via the recommendations made in this EPP. They will also be used to guide further growth of the program in future years as technology changes.
- Which instructional strategies could be integrated in the multimedia pathway

to differentiate instruction in ways that meet the needs of a diverse population?

Because the population of the multimedia pathway is entirely special education, differentiation of content is essential to supporting their learning. Hence, the interviewees' recommendations will be used as recommendations for the multimedia program.

Chapter 2

METHODS

A comprehensive examination of the literature as well as interviews with professionals in the field provided the knowledge base for this investigation. Guidelines for developing and assessing technological literacy and relevant curricula developed by other educators guided this EPP.

Specifically, this EPP compiles evidence from the literature and information from professionals in the field to inform the design of the Multimedia Pathway at Sunny High School. The key objectives of this paper are to (1) analyze the literature to inform the design and direction of this work; (2) interview professionals in the field of special education and technology to learn about their programs and to generate recommendations for the multimedia pathway at Sunny High School; and (3) use information from the literature and data gathered from interviews to inform the multimedia program so that it supports the technological literacy development of special education students.

Data Collection

The primary data-collection technique for this project was interviews conducted with professionals in the field of technology and special education. Interviews were conducted using a semi structured interview protocol. A semi structured interview protocol was chosen because the questions were being asked face-to-face and one-on-one with a structure and sequence to the questions. Semi structured interviews permit flexibility in the interview process and allow the researcher to utilize probing questions that help interviewees discuss their ideas in depth (Edwards & Holland, 2013). For this EPP, a semi structured format was appropriate because the

purpose of the examination was to engage interviewees in sharing their own views and experiences in depth, in ways that would allow the author to extrapolate lessons learned and provide recommendations for improving multimedia instruction at Sunny High School.

The data gathered are qualitative in nature, derived from the experiences and the professional opinions of the interviewees. The interview questions were aligned with the key questions that guided this EPP. In addition to questions aligned to the purpose of this EPP, biographical questions were used to establish the interviewees as professionals in their field and gain a better understanding of their workplace context. Table 2 demonstrates how the key questions of the EPP aligned to the interview questions. The questions were created so as to elicit from the interviewees answers that could be used to create recommendations for the multimedia pathway using their expertise in the field.

All questions were open ended. This allowed the interviewees to elaborate upon their answers, express opinions, and create responses with an array of data to analyze (Zorn, 2010). Interview questions were analyzed prior to implementation so as to minimize bias and guide the interviewees towards answers. The wording of the questions was scrutinized so as to use terminology that the interviewees would most likely be familiar with. The questions were worded in such a way so as to avoid framing them in a negative or a positive manner. They were worded as concisely as possible to minimize confusion due to word choice or verbosity.

The sequence of the questions was chosen so as to allow interviewees to introduce themselves first. This allowed them to establish themselves as experts and to feel comfortable answering questions they were confident in answering. From there,

the questions were sequenced in such a way that they explored the interviewees' professional experiences, such as professional development, and then their own practices in their field of expertise (Turner, 2010).

The interview guide helped ensure continuity and fidelity among the interviews. It served to safeguard the interviewees' rights and ensure they would understand the entirety of the process. Further, the interview guide allowed the investigator to cover the consent form and answer any questions that the interviewee may have had in its. Finally, the guide served to reduce variability in the way that the author presented the interview questions to the interviewee (McNamara, 2009).

Nine of the 12 interviews were conducted in person and averaged between 45-60 minutes. One interview lasted 123 minutes. Responses were audiotaped and transcribed; the audio tapes were then destroyed. Three interviews were conducted via email due to distance from the interviewee or scheduling conflicts. These emails, much like the audio tapes, were destroyed after being transcribed. The transcripts used pseudonyms to protect the identity of the interviewees.

Table 1

Interview Protocol

Question	Interview Question	Data Sources	Data Analysis	How Information Was Used
Biographical Question for Interviewee	What is your educational background? What is your position at the school /district where you work? How long have you been working in this position? What meaningful professional development experiences have you had in the field of educational technology?	Interview	Data collected and analyzed for the purpose of determining the best practices for this classroom.	Resources and data collected used to make curricular recommendations for the multimedia class.
What barriers to technological literacy acquisition to special education students face?	What barriers do students in your class face to becoming technologically literate? In what ways, if any, do you address these barriers?	Interviews with professionals, literature	Data collected and analyzed for the purpose of determining the best practices for this classroom.	Resources and data collected used to make curricular and instructional recommendations for the multimedia class.

<p>What specific technologies should special education students become familiar with in the context of the multimedia literacy pathway?</p>	<p>What specific technologies do you focus on in your classes? What technologies should students learn, if any, that you are not currently covering in your class?</p>	<p>Literature Interviews with Professionals</p>	<p>Data collected and analyzed for the purpose of determining appropriate technologies for this class.</p>	<p>Resources and data collected used to make curricular recommendations for the multimedia class.</p>
<p>What specific technological literacy skills should special education students acquire through the multimedia literacy pathway?</p>	<p>In your opinion, what specific technological literacy skills should special education students acquire through the multimedia pathway? What technological skills do you focus on in your own classes? What Delaware technological standards do you address in your classes? What emerging issues in technology, if any, do you address with your own</p>	<p>Interviews with professionals, literature</p>	<p>Data collected and analyzed for the purpose of determining the best practices for this classroom.</p>	<p>Resources and data collected used to make curricular recommendations for the multimedia class.</p>

	students? (i.e. cyber security, online identity theft, cyber harassment)			
What instructional strategies could be integrated in the multimedia literacy course to differentiate instruction in ways that meet the needs of a diverse population?	How do you differentiate instruction in ways that meet the needs of your students? What assistive technologies have you used in your classes?	Interviews with professionals, literature	Data collected and analyzed for the purpose of determining the best practices for this classroom.	Resources and data collected used to make curricular and instructional recommendations for the multimedia class.

Data Analysis

The purpose of analysis is to identify trends within the data so that the data can be explained (Charmaz, 2014). For the purpose of this EPP, open coding was utilized to identify emergent themes. The goal of open coding is to create labels that begin to explain the data in chunks or easily understood segments (Flick, 2002).

After being transcribed, all data were entered into an Excel sheet where they were then sorted by question. The data were then repeatedly read by the author and an initial set of codes was developed based on the key questions of the EPP. Large segments were broken into small manageable chunks by assigning codes to statements that aligned with the code. This allowed for the broad sets of data to be broken down

into statements that were similar. Recurring themes between the data sets emerged from this process. While working with the data a series of sub codes, known as child codes, emerged that helped to further sort the data. Those codes were not planned for prior to the interviews and emerged naturally from the data analysis.

The data were tallied by code. This served to determine how many times a code occurred in total during the interviews and made possible sorting the data to determine the primary themes (Charmaz, 2014). The final coding scheme is shown on Table 2. The goal here was to determine what the major themes of the data were while still paying attention to unique themes only mentioned by a few participants such as 3-D printing (Munhall, 2012).

To ensure reliability of the data analysis, interrater reliability procedures were implemented (McHugh, 2012). This process involved another individual looking at a subset of the identifier-free data and rating it using the same code system that the investigator did. Because this is a two-rater process, an agreement of 80% or greater was considered acceptable (McHugh, 2012). The data were rated in two rounds. First, the second rater looked at the data in chunks that had been coded by the author. The author did not provide his assigned code for this, so the second rater was unaware of the initial code. The second rater then applied the codes to the data chunks. The second rater assigned 80 codes with 73 of the 80 codes in agreement. This translated to a 91% agreement rate, higher than the 80% minimum established by McHugh (2012). The same process was done for all subcodes, with 41 of 50 instances in agreement. This established a rate of 82%, higher than the 80% minimum established by McHugh (2012).

Table 2

Coding Scheme

Code Identifier	Sub-Codes
Barriers	Meaningful pedagogical experiences Professional Development
Technologies for Special Education	Hardware Software Google applications Cloud-based technologies
Technological Literacy Skills	Collaboration Coding Data Management Job Applications Research Skills
Differentiated Instruction	Pedagogical Differentiation Technological Differentiation Assistive Technologies

Participants

Twelve professionals were interviewed for this study. According to Bernard (2006), 10 to 20 interview participants is an adequate sample. Twelve was the number of participants chosen to interview for several reasons. Practically speaking, meeting with, interviewing, and transcribing interviews from 12 participants is a very time-

consuming task for a single investigator. Travel time and communication avenues were also practical considerations limiting the field of participants (Robinson, 2013).

The initial participants were identified because they worked in the district where Sunny High is but did not work at Sunny High itself. They were chosen for their experience with special education and technology. When I interviewed these initial participants, I asked them whom they would recommend I speak with, a method called snowball sampling (Goodman, 1961). This allowed me to create a group of 12 participants.

Inclusion and exclusion criteria were developed to choose appropriate participants. Participants were chosen based on their professional experiences in educational technology, special education, or both. Individuals who did not work in special education or educational technology were excluded from the participant list as they did not have experiences relevant to this research (McElroy & Ladner, 2013).

Three of the professionals are technology teachers who are also certified to teach special education. Two are educational diagnosticians working at high schools, and two are school district personnel serving as specialists overseeing technology education throughout their districts, and both are special education certified. Two of them are assistive technology specialists; one works for the state of Delaware and the other works in a school district. One participant is a transition coach working with the Division of Vocational Rehabilitation. Two are school administrators, one of whom is an associate principal and the other is a program director who fills the role of principal at a private school for students with disabilities. Both of these administrators are also special education certified.

Eight of the 12 participants are female and four are male. All except two individuals are employed in the state of Delaware. All of the participants are over the age of 25 years. Nine of the 12 participants are certified to teach special education, although all of them work with special education students. Ten of the 12 participants are certified to be teachers. All participants have a master's degree. Table 3 describes the participants for this EPP.

Of the twelve participants, four work in the same district as Sunny High. None of them teaches at Sunny High, but one is a technology specialist for the district and another an assistive technology specialist for the district so they do interact with Sunny High's staff and students at times. It was decided on the part of the investigator to focus on individuals outside of the Sunny High district because there were no similar programs within the district to compare to. Also, the investigator expected that by broadening the demographics of the participants it would help bring in a more diverse array of suggestions.

There was a minimal risk of interviewees being identified; to contend with this, the tapes and emails were transcribed and interviewees were assigned pseudonyms. All identifiers were removed. The tapes and emails were destroyed. The consent forms of the interviewees will be stored for 3 years and then destroyed.

The participants could benefit from participation in that they may be able to use resources, information, and materials created from this project. Interviewees were selected based on their experience and having obtained at least a master's degree.

Table 3

Participants

<u>Pseudonym</u>	<u>Subject Area(s)</u>	<u>Years working in Profession</u>
Ms. Alpha	Technology Education-Teaches 7 th and 8th grade technology education in the Sunny High District	3
Ms. Beta	Technology Education-Teaches digital media storytelling courses 9th-12th grades	15
Mr. Gamma	Specialist-Sunny High District educational technology specialist, designs professional development programs for teachers and curriculum	15
Mr. Delta	Assistive Tech. Specialist- Specialist who provides assistive technology training to staff, parents and students.	22
Ms. Epsilon	Transition Coach- Works with special education students throughout the state of Delaware (and at Sunny high) with moving from being a high school student into work or further schooling	13
Ms. Iota	Specialist-Sunny High District Instructional specialist, former special education teacher, former instructional technology specialist, oversees instruction and curriculum alignment for the Sunny High District	33

Mr. Zeta	Assistive Tech. Specialist-Works for the state of Delaware training and promoting assistive technology for a diverse array of clients including special education students	23
Ms. Kappa	Technology Education-High school technology education teacher	18
Ms. Lambda	Administrator-Head of a private school for special education students	14
Ms. Mu	Educational Diagnostician- Manages, updates and maintains compliance of individualized Education Program documents for a high school.	15
Mr. Nu	Administrator-Former high school special education and technology teacher, currently an administrator in the Sunny District	14
Ms. Xi	Educational Diagnostician-Manages, updates and maintains compliance of individualized Education Program documents for a high school. Oversees the special education department to ensure compliance with IEP's and curricular alignment	31

Findings

Barriers to Technological Literacy

The first key question of the EPP intended to uncover barriers to technological literacy acquisition among special education students. Data to respond to this question were collected through two relevant items on the interview protocol: *What barriers do*

students in your class face to becoming technologically literate? and *In what ways, if any, do you address these barriers?* All 12 of the interviewees responded to both questions. Data analysis revealed that participants identified two critical barriers to technological literacy acquisition: lack of sound pedagogical practices that provide students with meaningful technology experiences and lack of professional development for teachers.

Meaningful pedagogical experiences with technology. All participants spoke at length regarding the need for exposing students to meaningful pedagogical experiences with technology. Mr. Gamma, a district-level technology specialist, highlighted the importance of providing students with meaningful pedagogical experiences. He defined meaningful experiences as “activities, lessons, and work that use technology in a way that furthers not only the students’ skills but their broader understanding of how technology can impact and change their world.” Discussing the importance of providing students with such experiences, Mr. Gamma noted:

In order for students to become technologically literate, they must have various experiences with diverse applications of technology. All too often, we fall into the path of using technology as a replacement, such as word processing to publish writing instead of paper and pencil. While this creates opportunities to become technologically literate, it does not push students to use technology further.

Mr. Zeta reinforced this point and stated that “access to technology and meaningful experiences (i.e., beyond Facebook) in school are critical for a student’s development into a technologically literate person.”

Mr. Gamma, however, noted that there are discrepancies in students’ prior

experiences based on their socioeconomic status:

Our students come to us with a large experience gap in their technology experiences. The students who are of higher socio-economic status typically have vast experience with computers and tablets by Kindergarten. In contrast, our students who are of lower socio-economic status may struggle to even have access to the Internet.

Similarly, a number of participants ($n = 7$) indicated that students need access to both high quality experiences as well as experiences that are relevant to the real world. Specifically, several participants indicated that there is a discrepancy between what is taught at schools and the types of technologies used in the real world. Ms. Xi stated, “There is a gap between what we can offer students at school (technologically speaking) and what they will encounter in the working world. The real world grows (technologically speaking) far faster than we as a school can.”

Mr. Gamma noted that insufficient access to technology is also a barrier when it comes to designing meaningful technology experiences for students. As he noted:

Another large barrier is the lack of devices. We do not currently have consistency with the number of devices per building. Some buildings may have four to five computer carts, whereas others may have only one. This creates an atmosphere where technology is rare; as such, teachers do not plan much that revolves around its use.

This issue highlights the need for not only access to technology at school but also

meaningful use of it when using what is available.

Four participants noted that students' views about technology also influence teachers' efforts to provide meaningful technology experiences. As they noted, technology is often viewed by students as a means for entertainment and not as a means of producing content and collaborating with others. As stated by Ms. Beta:

Many students view technology as only a source of entertainment and want to play games and chat but little else. They don't like it when technology 'becomes work,' and that is a challenge for teachers.

Access to professional development. The second barrier identified by participants was lack of professional development for teachers. Ms. Iota shared that the only professional development she ever received in using technology to teach was training in Flipped Classroom. Ms. Iota described Flipped Classroom as a model for teaching in which students access materials online from home and complete what would traditionally be homework assignments in the classroom. In this model, the lecture is online; in some cases, the lecture is prepared by teachers themselves using digital video, whereas in other cases, the lecture is an existing online resource such as a TED Talk. The homework is done in the classroom so that the teacher can guide the students' progress. Ms. Iota noted that "flipped classroom is interesting if the students can handle the large amount of responsibility it places on them." She expressed concern, however, in cases where "a student does not complete the assigned viewing or reading and thus misses the bulk of the lesson."

Ms. Iota noted that she did implement a flipped classroom instructional

approach in her classroom following the professional development. She explained:

I recorded screencasts of myself completing assignments and narrating what I am doing so students can have an example to watch at their own pace. The students really liked the screencasts and they allowed me to move around the room and help students when they needed instead of trying to model everything step-by-step and try to keep all students at the same pace.

Ms. Kappa also received professional development on flipped classroom, particularly how to create screencasts, which she subsequently implemented in her own practice. She shared:

I have received professional development in how to do screencasts and how they can be used to aid instruction. I record myself doing the lesson; then, as the students watch it in class, I can elaborate on points made in the video, replay parts for clarification, and engage with students one to one.

Other participants ($n = 5$) also spoke about lack of professional development even in cases of district-wide initiatives. For example, participants noted that a popular initiative within their district is the “Hour of Code,” an international initiative to provide a one-hour introduction to computer science, make students more comfortable with coding, and motivate an interest in computer science. Ms. Alpha, a technology educator, stated that the administration of her school encouraged participation in the “Hour of Code” but without accompanied support. She stated:

They have encouraged us as teachers to participate in this event but have not provided us with training in how to do it. I am comfortable with it myself, but I know many teachers are not. I would like to see training in this process be provided.

Responding to the second question, relating to the ways in which they address the identified barriers, most participants indicated that they engage in differentiation ($n = 9$), both pedagogical ($n = 7$) as well as technological ($n = 6$), which may also include use of assistive technologies ($n = 10$). Specific ways in which participants differentiate instruction in their classroom are presented later in this EPP.

Technologies Recommended for Special Education Students

The interview questions *What specific technologies do you focus on in your classes?* and *What technologies should students learn, if any, that you are not currently covering in your class?* helped to answer this key question. All 12 participants responded to this question. Although two of them were not certified teachers, they did teach technological skills to students with disabilities, so the question is still applicable. Participants' responses centered on four types of technologies that can be described as hardware ($n = 10$), software ($n = 6$), Google applications ($n = 8$), and cloud technology ($n = 2$). Table 4 provides an overview of the technologies recommended by the participants and their function.

Table 4

Technologies Recommended

Technology	Function
Hardware	
Tablets	A wireless personal computer that uses touchscreen technology to replace keyboard interfaces.
3D Printing	A technology that allows for the creation of custom 3-dimensional designs.

Software	
Microsoft Office	A productivity suite of programs for the creating of word, excel and PowerPoint documents.
CAD	Computer Aided Design (CAD), software that allows for the designing of 3D and 2D images
Smart Pen	Drawing tool that works in conjunction with CAD to design images
Google Applications	
Google Documents	Allows for the creation, storage and management of various documents. Users can collaborate in real time with other users worldwide.
Cloud Computing	
Dropbox	A cloud-based file sharing and storage platform.

The majority of the participants believed that students should be learning how to utilize Google Applications, particularly Google Documents. Google Documents is a cloud service that allows for the creation, storage, sharing, and collaboration on various products. These products include word processing documents, slideshow-type presentations, spreadsheet-type presentations, and Google Forms, which allows for the collection of data. All of these products support collaboration via the cloud by multiple users. Data can be shared and analyzed by various users simultaneously.

The strengths of the Google Documents technologies were noted by interviewees to be collaboration, data management, and accessibility. Ms. Alpha, a technology teacher, said:

One of the key elements of Google Documents is collaboration, which is a

key 21st century skill. We collaborate through Google Docs, Schoology discussions, and even blog sites. This allows students to communicate and share ideas and work together towards a project goal.

Mr. Beta expressed a need for students to be able to manage their data in its various forms using both cloud technology and physical devices. This further supported the need for students to learn how to utilize Google Documents because files can be managed via the cloud. He said:

Students in this class should be able to manage their data in effective ways using the cloud, Google Drive, physical storage, and digital storage (e.g., on computer, on a CD, on Dropbox).

Other participants discussed the need for students to learn more about 3D printing but noted financial limitations with this technology. Ms. Alpha stated:

I would love to teach 3D printing, but right now that is not financially viable. I think that students would be both highly engaged in the design process and would learn a ton of real-world skills related to design on computers and how an idea can become a reality.

Ms. Alpha did say, however, that she currently uses a smart pen that captures her drawing and translates it into computer-aided designs (CAD). She stated, “The smart pen is expensive, so I only have one for now, but the students and I can work with it and create 2D and 3D images on the computer.”

Technology Literacy Skills Recommended for Special Education Students

When asked to identify specific technological literacy skills for special education students, participants identified seven types of skills they considered essential for students’ future careers. These skills are illustrated in Table 5.

Table 5

Technological Literacy Skills Suggested

Tech Lit Skills	Description
Collaboration	Working with others via the web on a shared project
Coding	Producing and utilizing computer code
Data Management	Storing and retrieving digital data
Online Resume / Job Searching	Finding and applying for jobs online
Research Skills (online)	Finding adequate and correct information online

Mr. Zeta works in the field of assistive technology. He has worked with clients as young as toddlers to those well into their senior years. When asked what technological literacy skills should be taught to students in the multimedia pathway, he had a passionate answer related to the importance of helping students become creators of computing through coding: “Coding should be taught as a language just like Spanish starting in kindergarten through high school, and when possible, beyond.” When asked to elaborate, he said, “Programs will change, user interfaces will change, but coding at its core as a skill will not. Students who understand the code that drives technology will be equipped to adapt to any new technology that they are presented with.”

Ms. Lambda also felt strongly that coding should be taught through the multimedia pathway: “Coding [should be taught] even if it is not about syntax and math. There are visual ways to teach coding such as my favorite site, tynker.com. It is visual, and the kids feel like they are playing a game, but in reality, they are learning.”

Tynker.com is a site that allows users to explore the fundamentals of computer coding visually in a game-like setting.

Mr. Mu offered the recommendation of using codeacademy.com to teach coding to students at all levels. Codeacademy.com is a site that allows users to explore coding as they build a website and simple functioning programs via step-by-step tutorials and visuals. He explained that “students should engage with coding, and I feel codeacademy.com is an amazing free resource for doing this. Students can learn the fundamentals of HTML5 and begin to uncover the mechanics behind the tools that they use.” HTML 5 is the latest version of Hyper Text Mark up Language, the code used to create websites.

Ms. Iota, Ms. Xi, and Mr. Nu all felt that being technologically literate was essential to finding employment, not just to being employed. They advocated that students become fluent in managing their data online so that they can search and apply for work. They all believed that students must be fluent in finding information online and using that information to obtain their wants, such as a job. Ms. Iota said:

Technology use is integral to functioning in everyday life. Multimedia pathways must offer 21st century competencies and expertise throughout the learning experience. These would include the development of skills such as critical thinking, problem solving, collaboration, creativity, innovation, and communication. School technology experiences must engage, empower, and prepare students for careers that pay a living wage, or to postsecondary education, or both.

Mr. Nu specifically focused on the changing ways in which we find employment, noting, “Special education students should be exposed to technology

skills that can be used to gain employment after graduation or attend postsecondary school. They should be able to find and apply for jobs online and manage their online presence.” Similarly, Ms. Xi feels strongly that students must know how to look for needed information online such as job openings and how to apply for a job online. She said, “Online job applications can be fruitless if you do not know what to do and how to do it.” She suggested that students practice applying to jobs online long before they actually apply for real. Ms. Epsilon concurred, “Students should be able to answer online applications and research jobs online. They should know how to research the requirements for a job prior to even applying for it.”

Strategies for Differentiating Instruction

The interview questions *How do you differentiate instruction in ways that meet the needs of your students?* and *What assistive technologies have you used in your classes?* were created to address this key question. All 12 interviewees responded to each of these questions.

When discussing differentiation strategies, formative assessment with and without technology emerged as the primary strategy. In particular, most participants (n=10) stated that using formative assessments to drive differentiation was their way of reaching diverse learners. Ms. Alpha explained:

Through the use of formative assessment, instruction can be properly differentiated. Technology can play a large role in this. Whether you are using Google Forms for quick quizzes, Kahoot for exit tickets, or Schoology for discussion boards, you can gather data that will inform your instruction. From this point, you can place students in ability groups. I would always have the most struggling students working with the teacher. From there, you can use

technology to differentiate assignments for your remaining groups. For example, one group could be working on high level conceptual research related to a topic, while another focuses on review of concepts through a program like Khan Academy. I believe this to be effective K-12.

Ms. Iota also discussed the role of formative assessment in gaining a better understanding of students' background knowledge and preparing differentiated lessons: "Through the use of formative assessment, we as teachers can map student learning and better prepare the next lesson so that it addresses their gaps in understanding better."

Further, Ms. Iota discussed how she utilizes technology to engage in formative assessment that helps her differentiate instruction:

I can use technology to differentiate by creating interactive lessons that allow for formative assessment, through technology tools such as Kahoot. With Kahoot, students can participate in polls and quizzes where they interact with the activity via their cellphone or web enabled device. I can collect and see their answers and then use this data to adjust my lessons. The students think it is a lot of fun!

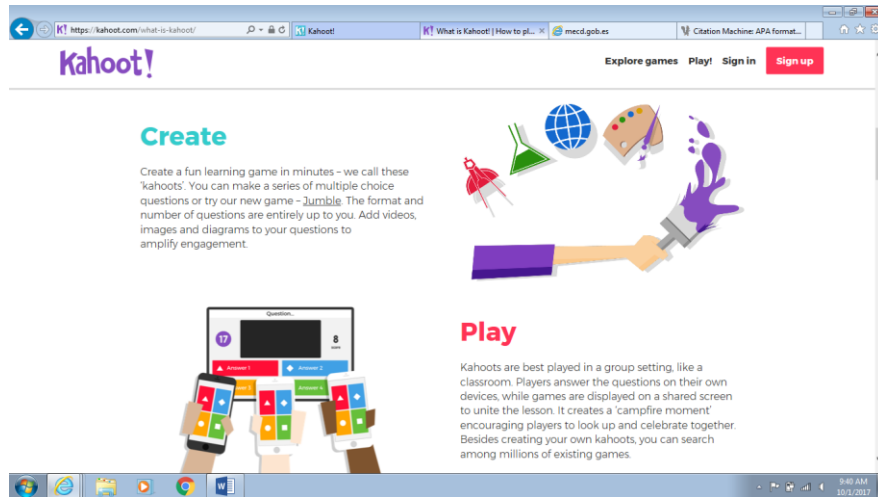


Figure 2. Kahoot Software for Formative Assessment

A number of teachers also indicated that they utilize assistive technologies to differentiate instruction for students with disabilities. Ms. Iota shared:

I have used scan-and-read software with students who have both reading disabilities and vision disabilities. This software reads text aloud to students. It reads individual problematic words or entire passages as needed by the student.

Mr. Delta, an assistive technology specialist, spoke about the need for technology that augments students' abilities without requiring extensive training in the technology itself. Mr. Alpha reinforced this comment and discussed the use of Tobi technology:

I like items like the Tobi. Tobi is a specialized computer that tracks the user's eyes and allows them to interact with the computer simply by looking at it. It also recognizes the user's voice and further allows interaction with it. This is an assistive technology that helps physically impaired students work with technology in a way that is accessible and

fun. They can complete assignments by themselves that they previously would have needed assistance from another person.

Ms. Zeta discussed assistive technologies related to dictation software such as Dragon Dictate. She noted:

Allow the students the use of adaptive aids and software that allows them to access the curriculum such as Dragon Dictate. Allow students to use large-print books and produce other written assignments in large print for students with visual impairments. Have students produce assignments in electronic formats for those who have difficulty with print access and reading disabilities as well as physical disabilities.

Ms. Xi stated that most of her experience with assistive technology comes from tablets, specifically iPads. She explained:

Students get iPads because it allows them to type as opposed to write. Students who have poor handwriting or behavioral goals that relate to completing assignments utilize iPads to great effect. It also helps students who have organizational goals in their IEP's. The iPad keeps all of their writing stored in one place.

Despite their recommendations, teachers also noted that the teacher remains critical in utilizing assistive technologies. Ms. Zeta explained:

Educators must understand how assistive technology fits into the equation. The technology does not do the teaching; the teacher does. The assistive technology allows students to overcome barriers and be successful in

situations [in which] they previously would not have been successful.

Teachers need to ask themselves how they and the student can best use the technology. I recommend all teachers use the assistive technology their students have at least once so as to get the perspective of the user.

Chapter 3

RECOMMENDATIONS

The purpose of this EPP was to gather information from professionals working in the fields of technology and/or special education in order to generate recommendations that would help to improve the multimedia pathway at Sunny High School. Data analysis revealed four primary themes that are used to generate recommendations. The compiled recommendations will be used to revise the pathway so that it supports the development of special education students' technological literacy.

Recommendation 1: Align the multimedia pathway with the Delaware and ISTE standards

The primary standards that should guide the multimedia pathway are Delaware technological standards 3.1.1, "Facilitate and Inspire Student Learning and Creativity," and 3.1.1.1, "Use knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments." These standards focus on what the instructor can do to facilitate student learning, creativity, and collaboration via technology. These standards are derived and adapted from the ISTE Standards for teachers.

The ISTE standards for students indicate that students must be empowered

learners and innovative designers (ISTE, 2017). Ms. Iota stated, “Multimedia pathways must offer 21st century competencies and expertise throughout the learning experience. These would include the development of skills such as critical thinking, problem solving, collaboration, creativity, innovation, and communication.” This statement supports the recommendation that these two standards guide the multimedia pathway teacher.

These standards were quoted by eight of the interviewees as being the standards that they address in their classes. Standard 3.1.1, “Facilitate and Inspire Student Learning and Creativity,” focuses on the teacher as an instrument of learning facilitation within the classroom. This standard asserts that the teacher’s job is to create an environment in which students can learn not only how to use technology but to also use it to create original products.

Standard 3.1.1.1. says, “Use knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments,” indicating that students must be given opportunities to use technology as a creative tool, a learning tool, and a collaborative tool. Ms. Alpha reinforced this practice:

The image of computer users as isolated is outdated. Computers are tools that allow people to work together regardless of where they are. In my classroom, students work together on projects on the computer but not at the same computer. Canva.com is one such site. The students create a team of other users and work together on creating digital images.

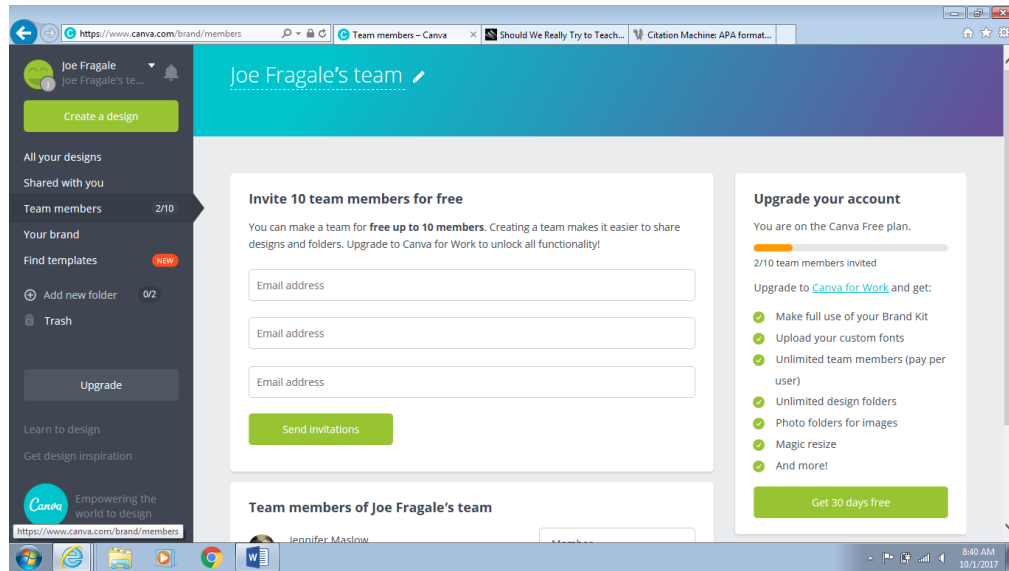


Figure 3. Canva.com

It is recommended that the multimedia teacher create activities and experiences that require students to collaborate in the creation of products via technology. These collaborations should not be limited to person to person as in real-life collaborations. Students and the teacher could use cloud-based technologies as virtual environments in which to share products and work collaboratively to create them. Students could learn to use technology as a means of communication that allows for them to collaborate on projects and further each other's learning (Bellarrain, 2007).

Administrators should support the use of resources that allow for these two standards to be addressed in the multimedia pathway. The Delaware Technological Administrator Standard 2.3, Digital Age Learning Culture, supports this by stating that, "Educational Administrators create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students."

Recommendation 2: Provide students with meaningful technology experiences

Students in the multimedia pathway should be exposed to a variety of meaningful experiences that empower them to use technology collaboratively as both a learning tool and a creative tool. Technology should not be used for the sake of using technology; rather, it should be used to enhance learning, collaboration, and instruction (Keengwe, Onchwari, & Wachira, 2008).

Mr. Gamma defined meaningful experiences as “activities, lessons, and work that use technology in a way that furthers not only the students’ skills but their broader understanding of how technology can impact and change their world.” Ms. Epsilon stated, “I see it all the time; there is a gap between students who have been exposed to technology that empowers them to change their world and those who have not. While in a school setting they should be provided with these experiences if their home life cannot.”

To accomplish this goal, the instructor of the pathway will have to improve his Technological Pedagogical Content Knowledge (TPACK) and related components. Technological Content Knowledge (TCK) refers to knowledge of how technology can create new representations for specific content. TCK suggests that teachers understand that by using a specific technology, they can change the way learners practice and understand concepts in a specific content area (Mishra & Koehler, 2006).

Ms. Iota supported this recommendation when she stated, “I find that I am at my best as a teacher when I am learning. Also, if I want to use a technology for instruction, I don’t just learn how the technology works, I learn how it can make my instruction better.” Mr. Gamma recommended that teachers utilize blogs and wikis to guide them through the process of learning how to use technology as an instructional tool. He stated, “Teachertube.com is a teacher-centric version of YouTube. You as a

professional can add content or consume the content of others. It is a great place to learn new skills.”

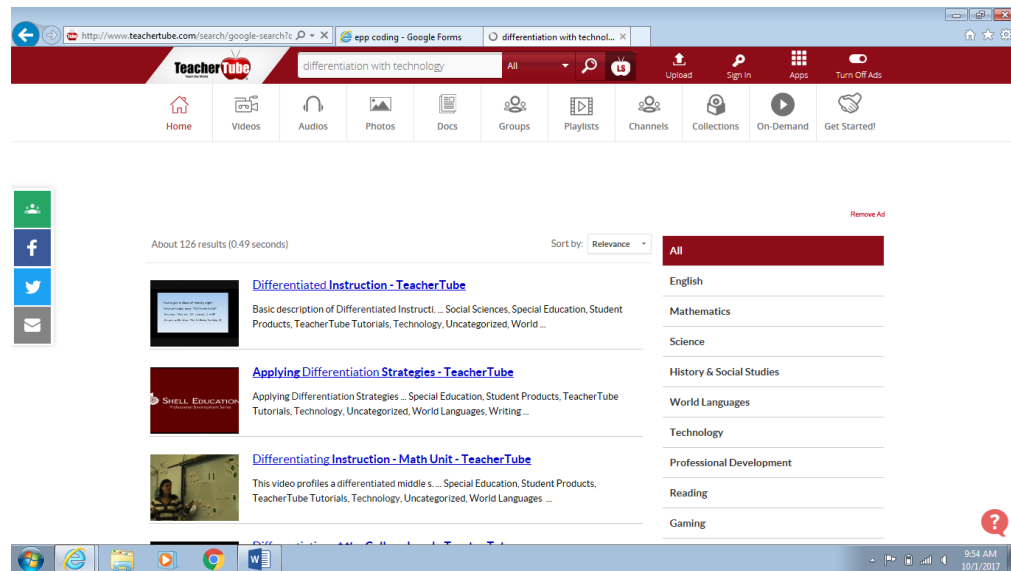


Figure 4. Teachertube.com

In addition to improving overall levels of TPACK, the multimedia teacher could also strive to become more comfortable with a wide range of technologies that are subsequently implemented in the multimedia pathway to support student technological literacy. As Ms. Xi said, “There is so much more technology out there than just cell phones and videogames. Can we ever cover it all? No, but if you expose students to a variety of technologies, then they can become familiar with big ideas that translate from situation to situation, or from technology to technology.”

It is recommended that the multimedia pathway should be revised so that students are exposed to a wide variety of technologies as well as meaningful experiences with those technologies that facilitate content creation, communication, and collaboration. Individuals who are not technologically literate and cannot collaborate via technology will be at a disadvantage in a 21st-century workplace

where collaboration and communication depend on technology (Crockett, 2015; ITEA, 2003).

Ms. Beta, however, identified challenges in using technology for meaningful educational activities. As she noted, “Many students view technology as only a source of entertainment and want to play games and chat but little else,” highlighting the need for students to be exposed to technologies in meaningful ways so that they begin to see their value beyond entertainment. Students should learn how technology allows them to work with others now so that they are familiar with the process when they enter the workforce (Crockett, 2015).

Regardless of what career students choose they will need to be technologically literate for the job searching process. Students will need to create and maintain an online resume, perhaps via linked.com or some other venue such as monster.com. They will have to search for job opportunities via the web regardless of the field they are in. Being technologically literate will be essential to finding and applying to jobs.

To achieve these goals, it is recommended that the instructor of the multimedia pathway use Google Documents to facilitate student collaboration and creativity. Learning experiences should be created that make use of Google Documents. This aligns with the Delaware State Technological Standard for Teachers 3.1.2, Design and Develop Digital Age Learning Experiences and Assessments.

Google Documents is an empowering technology that students should learn so that they can enhance their data management skills and learn how to collaborate online. As Ms. Alpha stated, “One of the key focuses is collaboration, which is a key 21st century skill. We collaborate through Google Docs, Schoology discussions, and even blog sites. This allows students to communicate and share ideas and work

together towards a project goal.”

Administrators should work to support the use of Google Documents throughout the district because it is a tool that is both a contemporary technology and it will enhance students learning. This is supported by ISTE Standard for Administrators 2.4, Excellence in Professional Practice, which states: “Educational Administrators promote an environment of professional learning and innovation that empowers educators to enhance student learning through the infusion of contemporary technologies and digital resources.”

Because access to Google Documents is free and Google Classroom is free to teachers, the implementation of this can be done with no expense because the multimedia pathway already has computers. Students can create documents and products comparable to those made in the Microsoft Office suite.

The multimedia pathway should also be revised to allow students to acquire skills in working with cloud-based technologies such as storing and accessing files on Google Documents, even for classes that are not related to the multimedia pathway. Mr. Beta stated, “Students in this class should be able to manage their data in effective ways using the cloud, Google Drive, physical storage, and digital storage (e.g., on computer, on a CD, on Dropbox). Ability to manage one’s data using Google applications or other cloud platforms is an important 21st century skill.”

According to the Student ISTE Standards, students are constructors of knowledge. “Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. Curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate

meaningful connections or conclusions” (ISTE, 2016). Google Documents will allow the curation of information and resources as well as student-produced artifacts via cloud storage.

Recommendation 3. Support students as creators of technology through coding

Coding should be taught as a skill to the students in the multimedia pathway. Coding is a technological literacy skill that allows for the students to understand the inner workings of computers and digital technology. Understanding how the code that drives the programs works deepens their understanding of technology as a whole and gives them the tools to adapt to new technologies as they emerge. Coding can be taught via educational websites, such as codeacademy.com and tynker.com.

Although not all jobs require knowledge of coding, students should be exposed to it so they understand how computers work (Crow, 2014). The world around us is heavily influenced by software (Crow, 2014). Mr. Zeta said, “Computational thinking is something every person can benefit from, and coding teaches this mode of thinking.” Students should learn to identify needs and visually express logic (Sehringer, 2015). Mr. Zeta supported this. He noted, “Programs will change, user interfaces will change, but coding at its core as a skill will not. Students who understand the code that drives technology will be equipped to adapt to any new technology that they are presented with.” Mr. Zeta also stated, “Those literate in language of code will be more proficient at navigating future technologies than those who are not.”

Mr. Mu offered the recommendation of using codeacademy.com to teach coding to students at all levels. “Students should engage with coding, and I feel codeacademy.com is an amazing free resource for doing this. Students can learn the

fundamentals of HTML5 and begin to uncover the mechanics behind the tools that they use.” Codecademy.com is a site that allows users to explore coding as they build a website and simple functioning programs via step-by-step tutorials and visuals.

It is recommended that the instructor of the multimedia course utilize codecademy.com as a self-paced way for students to learn coding. There are 21 free classes offered by codecademy.com with each one running from between 3 to 35 hours (Codecademy, 2017). The instructor could implement a program in which students work through the activities at their own pace and then use codecademy.com web-based software to create products that represent their learning. Mr. Mu proposed that it could be used at the beginning of each class as a warm-up and as a way to help the student’s transition into the multimedia pathway environment.

Coding is a creative process that empowers students to create new products or artifacts of learning. In conjunction others students will learn through coding how to create new products in a collaborative real world or virtual environment.

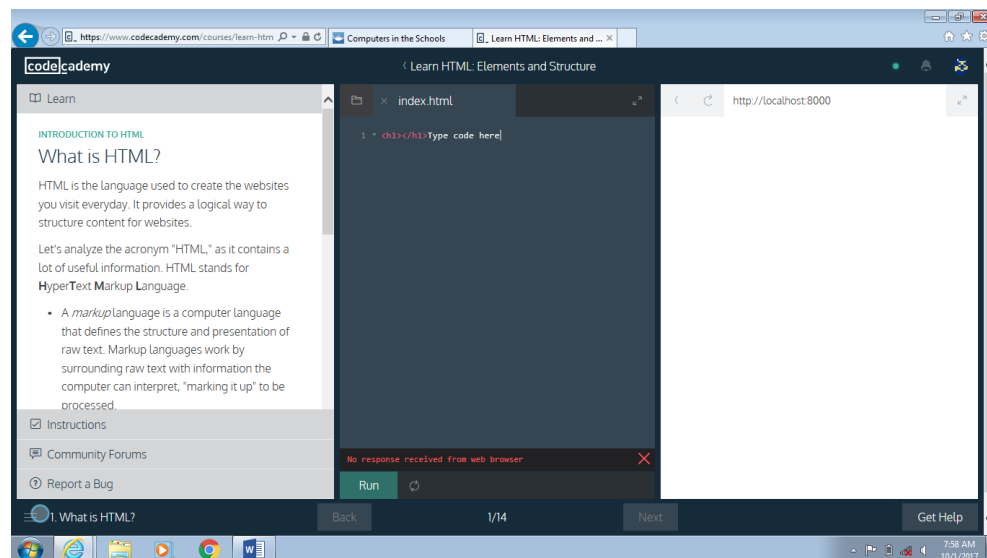


Figure 5. Codecademy.com

Figure 5 shows the structure of a codecademy.com lesson. The left bar is the content the students read. The middle area is a work area where the students input code while working through the instruction in the left bar. The right bar is the area where students can see the result of their work in the middle bar. As shown on Figure 6, the students work becomes a product in real time, in this case an HTML website.

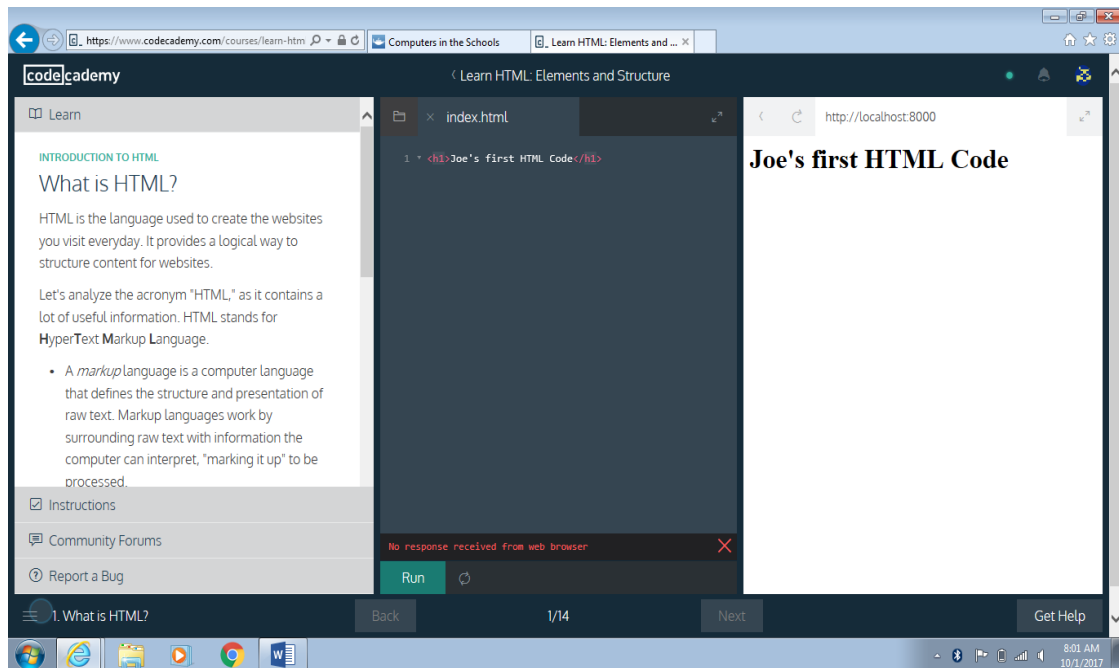


Figure 6. Codecademy.com HTML Lesson

Codecademy.com allows for the teacher to facilitate meaningful, creative experiences with technology as addressed by Delaware technological standards 3.1.1, Facilitate and Inspire Student Learning and Creativity, and 3.1.1.1, which states, “Use knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.” Students who struggle with the coding could study on tynker.com, another coding learning site that is aimed towards a younger audience

because it makes use of visuals such as ponies and dragons.

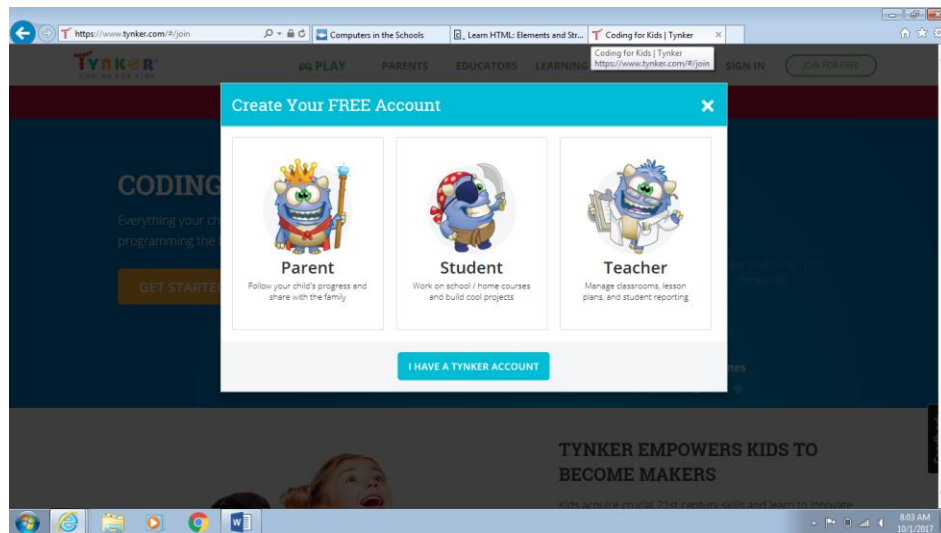


Figure 7. Tynker.com

With tynker.com, students learn the fundamentals of coding visually while being guided on screen by cartoon characters. The user strings together code by using the mouse to move codes into an assigned place. In the image above, the character is made to walk to the jellybean by the user attaching the “walk” code to the “on start” code. Unlike codecademy, tynker is not fully free.

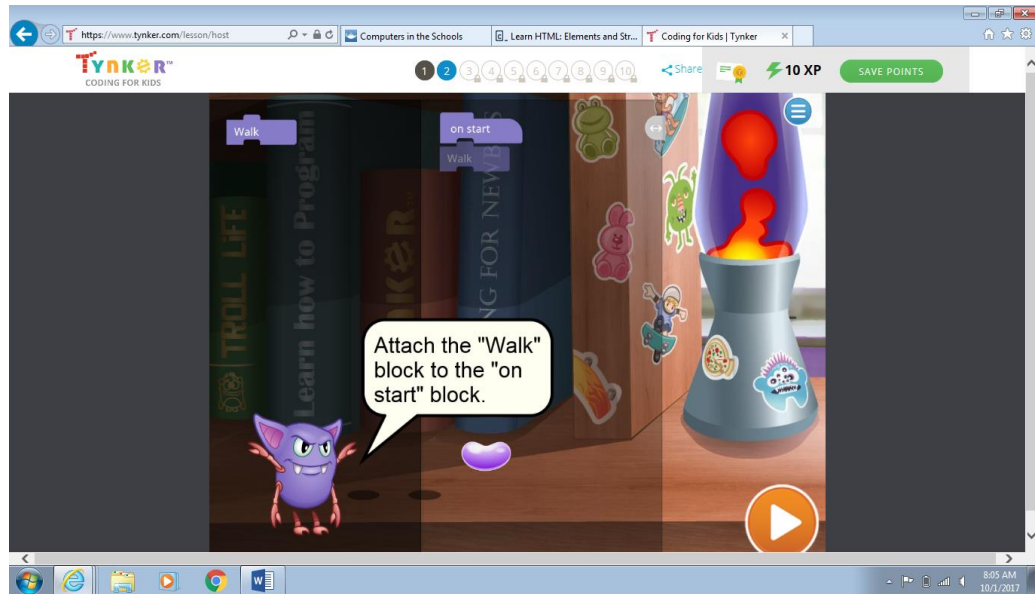


Figure 8. Tynker.com Code Lesson

Code.org is another free website that teaches coding. It includes lessons for students as young as kindergarten all the way up to university students. It also has accounts for teachers and students so that teachers can monitor the progress their students are making in the courses offered by code.org. Lessons are offered in a variety of formats, often using multimedia to teach and engage the students in the content. Teachers are provided with lesson guides and lesson plans.

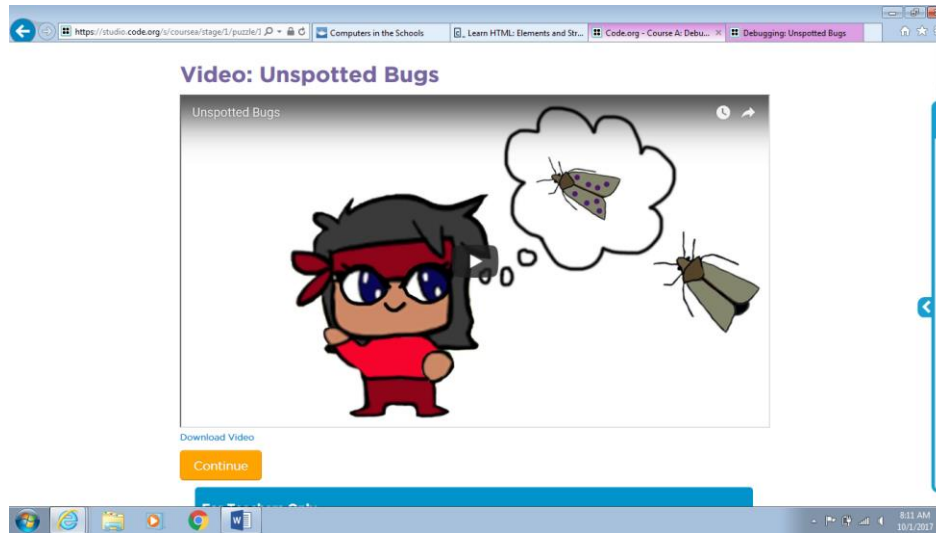


Figure 9. Code.org

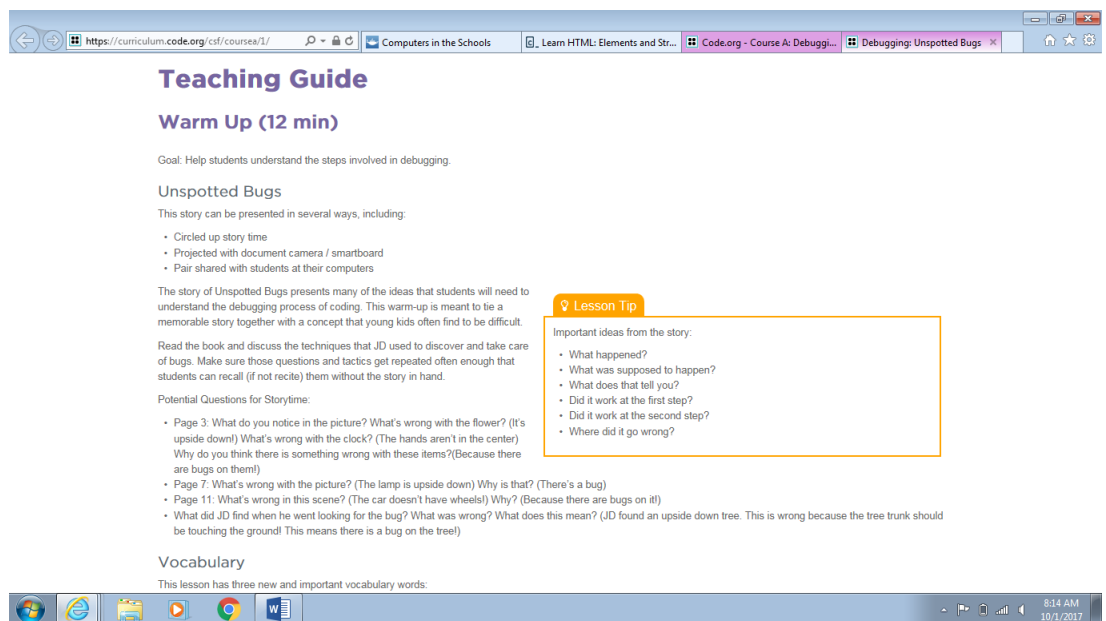


Figure 10. Code.org Teaching Guide

Students can enhance their learning in this area by engaging with portals such as codecademy.com, tynker.com, and code.org. Since these activities are provided via self-paced tutorials, students can access them from home to further their skills. As problems arise with their coding development, they can utilize Google Documents to

collaborate on the activities that they struggle with and share suggestions and answers to the problems that they have encountered.

Administrators can support the program by enrolling the school in the yearly Hour of Code event. This event encourages students to take a one-hour online computer science course (Hourofcode.com, 2017). Students who do not take the multimedia pathway will also benefit from this because they will be exposed to computer science and technological literacy skills.

Recommendation 4: Teachers should differentiate lessons, content and learning experiences

The multimedia pathway should utilize the Universal Design for Learning (UDL) framework in conjunction with technology and assistive technology so that learning can be accessed in a variety of ways by diverse learners. This format allows for multiple representations of information so that students can learn via multiple modalities. Learning can also be represented in various ways, frequently using technology. The UDL format allows for formative assessments via technology to drive differentiation of content to students.

As a UDL Assessment, the pathway teacher, could offer the students a “pick your own assessment activity”. Students would be presented with a variety of activities they could complete in order to show what they have learned. Students could use the Apple software Garage band to record a podcast about the topic being assessed. They could use iMovie to create a movie that teaches the viewer what they have learned. Google Documents could be used to create a slide show.

Differentiation could take the form of the instructor using Kahoot, a technology suggested by Ms. Iota, to create formative assessments. The students

would use their mobile devices to participate in real-time interactive games that serve as formative assessments. The instructor can then use the data to cultivate various resources that can be assigned to students via a virtual environment such as Google Documents. The flipped Classroom model could then be used to assign these resources to students so that they can receive differentiated instruction that is driven by the data collected via the Kahoot game. While working in the classroom, students could work collaboratively in groups based on the formative assessment data as suggested by Mr. Gamma to create artifacts that show their learning (CAST, 2011).

Universal Design for Learning is a framework for teaching variable learners (CAST, 2011) such as special education students using technology promoted and developed by the Center for Applied Special Technology (CAST). UDL has three domains. They are representation, action, and expression and engagement (CAST, 2013).

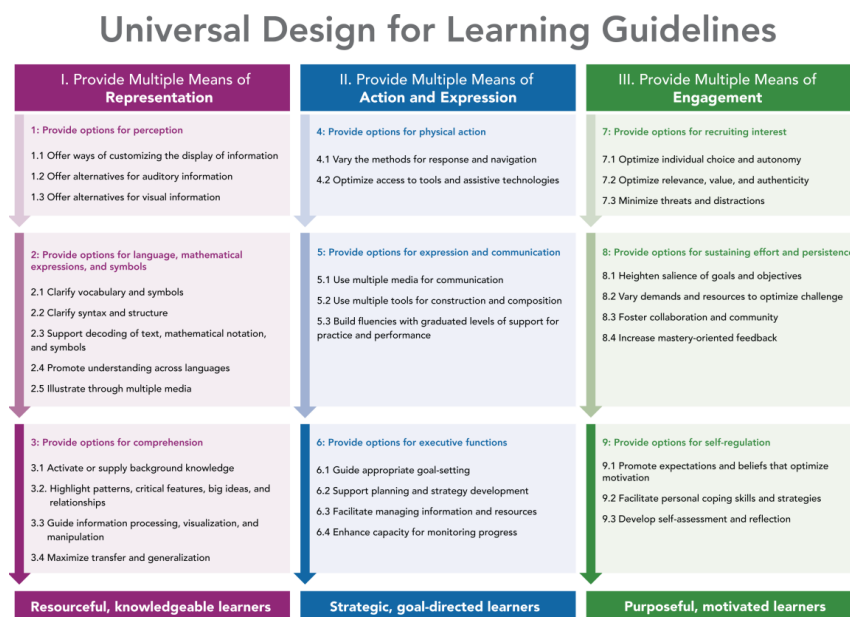


Figure 11. Universal Design for Learning

The strength of UDL is that it provides for multiple means of engagement and representations (CAST, 2011). It also allows for differentiation through technology, as Mr. Gamma observed, "Through the use of formative assessment, instruction can be properly differentiated. Technology can play a large role in this."

Administrators can support this by developing in-service lessons that teaches the teachers the proper way to implement UDL lessons into the classroom. They also need to support the cultivation of technological resources that can be used in conjunction with UDL to further student's achievement.

Limitations

This study was limited by the small number of professionals interviewed. Because only 12 professionals were interviewed, a small data set was created. A follow-up to this would be a larger-scale interview data collection in which the primary investigator would interview a wider array of professionals.

Although the investigator attempted to interview a diverse number of participants, the small size of the study along with its geographical constraints may not have allowed for participants with a diverse array of experience. Future research could focus on a larger geographical area or even a different area entirely. This would diversify the experiences of the individuals involved in the research.

Another limitation of the study was the potential for variables in the interview process to skew the data. To contend with this, an interview protocol was developed that guided the interviewer through each interview so as to reduce variables as much as possible.

Reliability of the investigator's coding is a potential limitation. That is why an interrater reliability protocol was enacted so as to check for correlation between two raters. There was an agreement of over 80% between the two raters.

Conclusions

The purpose of this EPP was to elicit information with professionals in the fields of technology and special education to generate recommendations for the multimedia pathway at Sunny High School. The investigator interviewed twelve professionals in the field and was able to generate recommendations that will be implemented into the multimedia pathway. The high school special education students who take the multimedia pathway will be in an environment where their technological literacy development will be supported by exposure to a diverse array of technologies.

Special education students need to be empowered to use technology effectively in the 21st century. Since technology is constantly advancing and changing, they need to become literate in skills that evolve with the evolution of technology, such as coding. Being able to collaborate with others is another skill that will be essential to success in the 21st century workforce. Utilization of the UDL framework in conjunction with the ISTE-inspired Delaware state standards will allow the teacher of this pathway to differentiate instruction in ways that meets the needs of diverse learners.

Students should use Google Documents as a means to collaborate on creative projects. They can also use it to collect artifacts of their learning. Coding should be taught as a skill, and codeacademy.com is an excellent way to do this. It is free and web based. Students work at their own pace and create artifacts of their learning. Finally, all teachers should be engaged in professional development that furthers their knowledge of technology, content and pedagogy (TPACK).

The recommendations to emerge from this study are not specific to special education students since they could be applied to all students. Since UDL assumes that there will be a variety of learners in any setting, it builds into the lesson various means

of accessing the learning material. Based on the findings in this study special education students need to be exposed to the recommendations made here so that they can be as technologically literate as their non-special-education peers.

REFERENCES

- Basham, J. D., & Marino, M. T. (2013). Understanding STEM education and supporting students through universal design for learning. *Teaching Exceptional Children, 45*(4), 8.
- Bernard, H. R. (2006). *Research methods in anthropology: Qualitative and quantitative approaches*. Lanham, MD: AltaMira Press.
- Center for Applied Special Technology (CAST). (2011). *Universal design for learning guidelines version 2.0*. Wakefield, MA: CAST. Retrieved from www.udlcenter.org/sites/udlcenter.org/files/updateguidelines2_0.pdf.
- Center for Applied Special Technology (CAST). (2011). *Universal design for learning guidelines (Version 2.0)*. Wakefield, MA: Author. Retrieved from <http://www.udlcenter.org/aboutudl/udlguidelines>
- Center for Applied Special Technology (CAST). (2013, December 2). UDL Guidelines 2.0. Retrieved September 15, 2017, from <http://www.udlcenter.org/aboutudl/udlguidelines>
- Chandler-Olcott, K., & Mahar, D. (2003). "Tech-savviness" meets multiliteracies: Exploring adolescent girls' technology-mediated literacy practices. *Reading Research Quarterly, 38*, 356-385. doi:10.1598/RRQ.38.3.3
- Charmaz, K. (2014). *Constructing grounded theory*. London: Sage Publications.
- Codecademy. (2017). Retrieved September 15, 2017, from <https://www.codecademy.com/learn/all>
- Cox, M., Abbott, C., Webb, M., Blakely, B., Beauchamp, T., & Rhodes, V. (2004). ICT and pedagogy—A review of the literature. *ICT in Schools Research and Evaluation Series, 18*. London, England: DfES/BECTA.
- Crockett, R. (2015). *The critical 21st century skills every student needs and why*. Retrieved from <http://globaldigitalcitizen.org/critical-21st-century-skills-every-student-needs>
- Crow, D. (2014, February 07). Why every child should learn to code. Retrieved October 01, 2017, from <https://www.theguardian.com/technology/2014/feb/07/year-of-code-dan-crow-songkick>

Davies, R. S. (2011). Understanding technology literacy: A framework for evaluating educational technology integration. *TechTrends*, 55(5), 45-52.

Delaware State Technological Standards. (2007). Retrieved from http://www.doe.k12.de.us/infosuites/staff/ci/content_areas/files/tech/Technologybinder8-30.pdf

Delaware Technology Definitions. (2007). *Delaware Technology Education Teacher Resource Guide*. Retrieved from <http://www.doe.k12.de.us/cms/lib09/de01922744/centricity/domain/137/B-delaware%20technology%20education%20definitions.pdf>

DOE Annual Snapshot. (2017). Retrieved October 16, 2017, from <http://profiles.doe.k12.de.us/SchoolProfiles/District/Default.aspx?DistrictCode=24&checkSchool=0>

Edwards, R., & Holland, J. (2013). *What is qualitative interviewing?* London: Bloomsbury 2-3.

Edyburn, D. L. (2001). Models, theories, and frameworks: Contributions to understanding special education technology. *Special Education Technology Practice*, 4(2), 16-24.

Ezziane, Z. (2007). Information technology literacy: Implications on teaching and learning. *Journal of Educational Technology & Society*, 10, 175-191. Retrieved from <http://www.jstor.org/stable/jeductechsoci.10.3.175>

Ficklen, E., & Muscara, C. (2001). Harnessing technology in the classroom. *American Educator*, 25(3), 22-29.

Flick, U. (2002). *An Introduction to qualitative research*. London: Sage Publications.

A framework for addressing learner variability. (2017). Retrieved from <http://www.udlnet-project.eu/>

Framework for 21st Century Learning. (2017). Retrieved October 16, 2017, from <http://www.p21.org/our-work/p21-framework>

Goodman, L. A. (1961). "Snowball sampling." *Annals of Mathematical Statistics*, 32(1): 148–170. doi:10.1214/aoms/1177705148

Hackbarth, S. (2004). Changes in 4th-Graders' Computer Literacy as a Function of Access, Gender, and Race. *Information Technology in Childhood Education Annual*, 2004(1), 187-212. Association for the Advancement of Computing in Education (AACE).

Hitchcock, C. (2001). Balanced instructional support and challenge in universally designed learning environments. *Journal of Special Education Technology*, 16(4), 23-30.

Hourofcode.com. (2017). *Hour of Code: Anybody can learn*. Retrieved September 15, 2017, from <https://hourofcode.com/us>

International Society for Technology in Education Standards: Teachers. (2008, January 1). Retrieved from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf

ISTE Standards for Students. (2017). Retrieved October 16, 2017, from <https://www.iste.org/standards/for-students#startstandards>

Kavilanz, P. F. (2016, May 17). *How tech literate are 8th graders? You'd be surprised*. Retrieved from <http://money.cnn.com/2016/05/17/technology/eighth-graders-technology-engineering-literacy/>

Keengwe, J., Onchwari, G., & Wachira, P. (2008). Computer technology integration and student learning: Barriers and promise. *Journal of Science Education and Technology*, 17, 560-565.

Khan Academy. (2017). *Using Hour of Code in your classroom*. Retrieved from <https://www.khanacademy.org/computing/hour-of-code/hour-of-code-for-teachers/a/using-hour-of-code-in-your-classroom>

Koehler, M. J., & Mishra, P. (2008). Introducing TPCK. In AACTE Committee on Innovation and Technology (Ed.), *The handbook of technological pedagogical content knowledge (TPCK) for educators*, 3-29. Mahwah, NJ: Lawrence Erlbaum Associates.

Lenhart, A., Madden, M., & Hitlin, P. (2005, July 27). *Teens and technology: You are leading the transition to a fully wired and mobile nation*. Retrieved from http://www.pewinternet.org/files/old-media/Files/Reports/2005/PIP_Teens_Tech_July2005web.pdf.pdf

Levin, D., Arafah, S., Lenhart, A. & Rainie, L. (2002). *The digital disconnect: The widening gap between Internet-savvy students and their schools: PEW Internet & American Life Project*. Retrieved from <http://www.pewinternet.org/2002/08/14/the-digital-disconnect-the-widening-gap-between-internet-savvy-students-and-their-schools/>

McElroy, L. M., & Ladner, D. P. (2013, September 28). *Defining the study cohort: Inclusion and exclusion criteria*. Retrieved from <https://link.springer.com/chapter/>

10.1007/978-1-4471-4679-7_11

McNamara, C. (2009). *General guidelines for conducting interviews*. Retrieved from <http://managementhelp.org/evaluatn/intrview.htm>

Marino, M. T. (2009). Understanding how adolescents with reading difficulties utilize technology-based tools. *Exceptionality*, 17, 88-102.

Maryland Educational Technology Standards for Students. (2009, February 1). Retrieved from <http://www.montgomeryschoolsmd.org/departments/echlit/>

Mescar, D. (2016, September 21). *Education Technology In The Every Student Succeeds Act*. Retrieved October 16, 2017, from <https://ioeducation.com/education-technology/>

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, 276-282. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3900052/>.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108, 1017-1054.

Munhall, P. L. (2012). *Nursing research: A qualitative perspective*. Sudbury, MA: Jones & Bartlett Learning.

Queen, B., & Lewis, L. (2011). *Distance education courses for public elementary and secondary school students: 2009-2010* (NCES 2012-008). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Resnick, M. (2013). Learn to code, code to learn. *EdSurge*, May 2013. Retrieved from <https://www.edsurge.com/news/2013-05-08-learn-to-code-code-to-learn>

Robinson, O. C. (2013). *Sampling in interview-based qualitative research: A theoretical and practical guide*. Retrieved from <http://www.tandfonline.com/doi/abs/10.1080/14780887.2013.801543?journalCode=uqrp20>

Saxena, S. (2014). *Integrating technology in a special education classroom*. Retrieved from <http://edtechreview.in/news/855-integrating-technology-in-a-special-education-classroom>

Sehringer, M. G. (2015, August 06). *Should we really try to teach everyone to code?* Retrieved October 01, 2017, from <https://www.wired.com/insights/2015/02/should-we-really-try-to-teach-everyone-to-code/>

Standards for technological literacy: Content for the study of technology (2007, 3rd

ed.). Reston, VA: International Technology Education Association.
Technological literacy for all: A rationale and structure for the study of technology
(2nd ed.). (2006). Reston, VA: International Technology Education Association.

Toldi, L. D. (2016, June 14). *Why Special Education Technology Needs to Go Beyond The Screen*. Retrieved October 16, 2017, from https://www.huffingtonpost.com/ladislav-toldi/why-special-education-tec_b_10463702.html

Tomlinson, Carol (2001). *How to Differentiate Instruction in Mixed-Ability Classrooms: Differentiated Instruction provides access for all students to the general education curriculum: The method of assessment may look different for each child, however the skill or concepts taught is the same. Classrooms (2 ed.)*. Alexandria, VA: Association for Supervision and Curriculum Development. ISBN 0871205122

Turner, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The Qualitative Report*, 15, 754-760. Retrieved from <http://nsuworks.nova.edu/tqr/vol15/iss3/19>

Wagner, T. (2010). *The global achievement gap: Why even our best schools don't teach the new survival skills our children need – and what we can do about it*. New York, NY: Basic Books.

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2011). *Keeping pace with K-12 online learning: An annual review of policy and practice*. Mountain View, CA: The Evergreen Group.

Zorn, T. (2010). *Designing and conducting semi-structured interviews for research*. Retrieved from <http://home.utah.edu/~u0326119/Comm4170-01/resources/Interviewguidelines.pdf>

Appendix A

IRB CERTIFICATE



RESEARCH OFFICE

210 Hullihen Hall
University of Delaware
Newark, Delaware 19716-1551
Ph: 302/831-2136
Fax: 302/831-2828

DATE: April 3, 2017

TO: Joseph Fragale
FROM: University of Delaware IRB

STUDY TITLE: [1021420-1] Increasing levels of technological Literacy Amongst Special education Students at Smyrna High School

SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: April 3, 2017
EXPIRATION DATE: April 2, 2018
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review categories 6 and 7

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Appendix B

RECRUITMENT EMAIL

Hello (Name),

The purpose of this email is to ask whether you are interested in participating in a study required for completing my EdD at the University of Delaware. The purpose of this study is to provide curriculum recommendations for the multimedia pathway at Sunny High School to better support the development of technological literacy among special education students. You are asked to participate because you are a professional the field of technology and special education, such as technology coordinator, special education coordinator, or school administrator. If you choose to participate, you will be interviewed in person for approximately 45-60 minutes. Responses will be audiotaped. There is a minimal risk that you will be identified and to contend with this the tapes will then be transcribed and you will be designated a pseudonym and all identifiers will be removed. You may benefit from materials and procedures created in the future from this research.

Please feel free to contact me with any questions or to arrange your interview.

Appendix C

INFORMED CONSENT FORM

INFORMED CONSENT TO PARTICIPATE IN RESEARCH

Title of Project: Increasing levels of technological Literacy Amongst Special education Students at Sunny High School

Principal Investigator: *Joseph Fragale*

You are being invited to participate in a research study. This consent form tells you about the study including its purpose, what you will be asked to do if you decide to take part, and the risks and benefits of being in the study. Please read the information below and ask us any questions you may have before you decide whether or not you agree to participate.

The purpose of this research is to speak with professionals in the field of technology and special education from districts throughout Delaware to gather recommendations for the multimedia pathway at Sunny High School that supports the development of technological literacy among special education students. All research will be used in my executive position paper.

You will be one of approximately 12 to 15 participants in this study. You are being asked to participate because you are knowable in the fields of education administration, special education or educational technology. You are being asked to participate because you have a master's degree in your field of expertise.

WHAT WILL YOU BE ASKED TO DO?

As part of this study you will be asked to answer a series of open ended questions. The questions pertain to the technological literacy needs of special education students in the Sunny School District. The questions will be presented in a semi-structured interview protocol format. You will be interviewed for between 45 minutes to 60 minutes and the interview will be audio taped.

WHAT ARE THE RISKS AND BENEFITS OF PARTICIPATING IN THIS SURVEY?

There are no immediate risks or benefits for you as a participant in the study. However, the results of the study will be helpful in shaping the experiences of special education students in the field of multimedia literacy.

You will benefit indirectly by acquiring knowledge of the technology competencies valued by other professionals in their field, for students of special education.

Participation in this project may lead to the development of materials and procedures that may support you later.

HOW WILL CONFIDENTIALITY BE MAINTAINED? WHO MAY KNOW THAT YOU PARTICIPATED IN THIS RESEARCH?

All data will be kept on a password-protected hard-drive which is only accessible by the investigator. All print materials will be kept in locked file cabinets in the investigator's office. All study materials will be kept for three years and then destroyed. After analyzing all of the collected information for common and major themes, I will report the findings in my Executive Position Paper. I may also present the findings to scholarly conferences. To maintain confidentiality, pseudonyms for participants will be used and no personally identifying information will be reported.

The confidentiality of your records will be protected to the extent permitted by law. Your research records may be viewed by the University of Delaware Institutional Review Board, which is a committee formally designated to approve, monitor, and review biomedical and behavioral research involving humans. Records relating to this research will be kept for at least three years after the research study has been completed.

WILL THERE BE ANY COSTS TO YOU FOR PARTICIPATING IN THIS RESEARCH?

There will be no costs to participate in this research.

WILL YOU RECEIVE ANY COMPENSATION FOR PARTICIPATION?

There will be no compensation provided for participating in this study.

DO YOU HAVE TO TAKE PART IN THIS STUDY?

Your participation in this study is completely voluntary; there is no consequence for not participating. You may also withdraw from the project at any time without penalty, at which point any information collected from you for study will be destroyed and not included in the project. Your decision to withdraw from the study will not influence current or future relationships with the University of Delaware.

WHO SHOULD YOU CALL IF YOU HAVE QUESTIONS OR CONCERNS?

If you have any questions about this study, please contact the Principal Investigator, Joseph Fragale, at (302) 464-5133 or jfragale@udel.edu. You may contact my academic advisor Dr. Chrystalla Mouza at cmouza@udel.edu.

If you have any questions or concerns about your rights as a research participant, you may contact the University of Delaware Institutional Review Board at hsrb-research@udel.edu or (302) 831-2137.

Your signature on this form means that: 1) you are at least 18 years old; 2) you have read and understand the information given in this form; 3) you have asked any questions you have about the research and the questions have been answered to your satisfaction; and 4) you accept the terms in the form and volunteer to participate in the study. You will be given a copy of this form to keep.

Printed Name of Participant
Participant Date

Signature of

Person Obtaining Consent
Date

Person Obtaining Consent

(PRINTED NAME)

(SIGNATURE)

OPTIONAL CONSENT TO BE CONTACTED FOR FUTURE STUDIES:

Do we have your permission to contact you regarding participation in future studies? Please write your initials next to your preferred choice.

_____ YES

_____ NO