

Digital Visions:  
Developing 21<sup>st</sup> Century Skills and Competencies with the Digital Media Academy

By

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## Abstract

This thesis proposes the need for a comprehensive digital literacy program in Ontario schools. A K-12 digital literacy program is essential so that students can grow up with a set of 21<sup>st</sup> century skills and competencies that prepare them for life in an increasingly complex and digital world. The lack of unified digital literacy instruction in Ontario schools has led to an investigation of a US based Science, Technology, Engineering, and Math (STEM) academy called the Digital Media Academy. The Digital Media Academy offers programs for students, teachers, and adult learners in range of digital media disciplines. A qualitative study was designed to extract insights from the Digital Media Academy to establish a digital literacy framework worthy of the Ontario classroom. An ethnographic study was performed and eight interviews were conducted with eight curriculum staff from the Digital Media Academy. The results formed the basis of a comprehensive digital literacy program synthesized through the critical lens of an Ontario educator. The Ontario classroom would benefit from a digital literacy program that encompasses a creation-based learning platform that is intertwined with a human-centred design approach and teaches students to adopt a growth mindset, tell digital stories, learn to code, and make use of relatively inexpensive technologies.

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## Chapter 1: Digital Learning in the Non-formal Learning Sector

Ontario's kindergarten to grade 12 students are coming to school at a time when new information technologies have transformed how people work, play, and learn. With this exposure comes a great deal of learning potential for Ontario teachers and students. Modern technologies certainly have their benefits, but they also present us with a new and sometimes unfortunate set of learning outcomes. On the one hand, our level of connectedness affords incredible learning opportunity and allows teachers and their students to connect with other learners around the globe. This learning potential is described by Marshall McLuhan as a *Global Village*, which expresses the idea that electronics have the potential to disseminate information across the globe as easily and seamlessly as in a small village (McLuhan & Powers, 1992). On the other hand, this level of connectedness presents negative learning potential which stems from political rhetoric, unethical advertising and media, and misinformation. Ontario youth are exposed to a great number of advertisements and news media in our information-saturated environment. In order to distinguish between positive and negative learning outcomes, teachers and students must possess the appropriate digital literacy skills that allow them to explore our connected world through a critical lens. This critical lens will allow them to safely navigate our media saturated world and develop a refined set of skills that teach them to be safe, innovative, responsible, and creative.

Technology and its impact on the classroom and education vary from school board, to city, to province. In Ontario, the curriculum is quite vague when it comes to outlining technology as a tool for instruction, whereas provinces like British Columbia feature quite explicit ideas of how teachers should include technology in their classrooms. As an example, the

*Applied Design, Skills and Technologies* grade 7 curriculum expects students to learn about *robotics, power technology, digital literacy, and computers and communication* devices (British Columbia, 2015). Despite the disparities in technology-explicit-curricula across Canada, all provinces hold some affinity to the prospect of technological advancement and its effects on learning. With the ever-changing technological landscape, it is incredibly challenging to keep up with the newest technology and even more difficult to stay current inside the classroom.

Many families, students, and educators in Ontario are seeking exposure to digital literacy instruction in an educational context, but the formal school system is struggling to provide students with the cutting-edge technologies and work environments they expect in the 21<sup>st</sup> century. As a result, some Ontarians are seeking 21<sup>st</sup> century learning opportunities from non-formal learning environments like the Digital Media Academy. This is not to say that cutting edge education opportunities are not available in all Ontario schools, but to say that the instruction is not unified or mandated, which results in inconsistent learning opportunities. It is also important to note that non-formal learning environments like the Digital Media Academy are naturally at an advantage because they have the flexibility and bureaucratic freedom to implement new curriculum, instructional designs, and technologies at a much faster rate than the Ontario government. To provide an example, the Ontario Math 1-8 curriculum was implemented in 2005 and thus is the most current document available for teaching in Ontario schools and Faculties of Education, although it is outdated in terms of what is available for teaching with technology. The length of time it takes to design a new curriculum and effectively integrate it into the classroom makes it a challenge for the government of Ontario to keep up with new and emerging technologies. As a result, many teachers and administrators have taken

it upon themselves to organize robotics and coding clubs and are independently navigating the digital landscape. As an example, the Simcoe County District School Board hosted a conference titled, *Leveraging digital technologies for deep learning*, to engage educators in new teaching pedagogy intertwined with new technologies and programs like computer coding, drones, GoPro video editing, and augmented realities (SCDSB, 2017).

In the US, educators have the International Society for Technology in Education (ISTE) to look to for guidance when teaching students to be digitally literate. ISTE develops performance assessment standards for technology education in accordance with the National Council for Accreditation of Teacher Education (NCATE) and operates in accordance with State standards. ISTE provides standards and even sample lessons for K-12 educators to support a comprehensive digital literacy program in US schools. The standards provided are accompanied with sample assessment tasks, professional development opportunities, and access to a professional online community of educators. In Canada, Media Smarts is one of the few organizations educators can look to for guidance regarding digital and media literacy. As a non-profit, Media Smarts receives most of its funding from private telecommunication corporations, government grants, and licensee agreements. Media Smarts has been developing digital and media literacy programs in Canada since 1996 and its website provides extensive Canadian-based research and frameworks to help students, parents, schools, and communities decipher and interpret our media-saturated world. Media Smart's core mission and vision is to enhance youths' critical thinking skills so that they can engage with media as informed digital citizens. Although Media Smarts provides educators with sample lessons and guidance in the classroom, the organization is not as closely aligned with Provincial standards as ISTE is to State standards.

Media Smarts provides educators with an extensive digital literacy framework and definition that will be used to bring Canadian context to this thesis.

### **Research Context: The Digital Media Academy**

The Digital Media Academy (DMA) is a US nationally-recognized organization that provides hands-on learning experiences in a broad range of digital media technologies. The DMA offers summer camps for children and teens and Pro-Series courses for educators and adult-learners. Founded in 2002 out of Stanford University, DMA is best known for its premier summer programs hosted at prestigious destination campuses, such as Stanford University, Harvard University, and the University of Texas. In addition to these three locations, the DMA is spread across the US and Canada in 22 other locations. The DMA operates in Canada out of the University of Toronto, McGill University, and the University of British Columbia. The DMA serves students aged 6-17 in the summer months, but also offers online courses all year for participants of any age. In addition to its summer programs, DMA provides on-site training to schools and companies and offers workshops throughout the year at its training center in Silicon Valley, California. The DMA offers courses in a variety of digital media disciplines including, 3D Modeling and Design, Programming, Game Design, Robotics and Engineering, Music Production, and Film and Photography. DMA provides the latest technology to its students and has partnerships with many organizations, most notably with Apple, Adobe, and Canon.

As a Primary, Junior, and Intermediate educator in Ontario, as well as the DMA Program Director at the University of Toronto, many experiences have shaped and transformed my understanding of 21<sup>st</sup> century education. The biggest impact came from my training as Program

Director at the DMA headquarters in Silicon Valley, California, where I was exposed to virtual reality equipment, 3D printers, and many computer programming languages. This exposure came weeks after graduating with a Bachelor of Education Degree and an Ontario College of Teachers certification. The technologies used at the DMA were placed in an educational context and provided an incredibly engaging learning experience. This exposure sparked a series of questions regarding the need, or ability, to integrate this teaching into my own practice. These experiences and questions shaped this thesis and fueled an investigation of digital literacy teaching and learning in Ontario.

### **Research Purpose: Curriculum and Instruction**

This thesis aims to develop a comprehensive overview of the benefits of digital literacy in education, the different ways to integrate this instruction into the classroom, and to express the need for digital literacy instruction in formal educational contexts. The formal education system should provide access to proper instruction because most families in Ontario cannot afford the cost of sending their children to non-formal education environments like the DMA, which offers 5-day summer camps with costs that range from \$900 to \$1400 CAD. The intellectual property, or curriculum and design at the DMA, is its greatest asset. The curriculum at the DMA is the focus of this investigation and is analyzed through a series of interviews with eight curriculum staff. The DMA curriculum has an excellent reputation and provides insight into the design and implementation of a digital literacy program. To provide an example, the curriculum at DMA was recently purchased by the National Aeronautics and Space Administration (NASA) for their Robotics Alliance Project.

After eight interviews with eight curriculum staff at the DMA, six themes emerged and

underlined the most important digital media skillsets and competencies for the 21<sup>st</sup> century<sup>1</sup>, which were then analyzed through the lens of an Ontario educator and placed within the context of the formal Ontario K-12 classroom. The following represents the findings from eight interviews:

1. A digital literacy program must adopt a human-centered design approach with an emphasis on empathy;
2. A digital literacy program must teach real-world computer coding starting at a young age;
3. A digital literacy program must have an emphasis on content creation;
4. A digital literacy program must adopt and make use of Carol Dweck's growth mindset to teach students that failure is an integral part of learning; (Dweck, 2006)
5. A digital literacy program must make use of digital storytelling as an assessment strategy; and
6. A digital literacy program can use low, medium, and high level technologies to achieve full digital literacy;

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<sup>1</sup> For the purposes of this research project, 21<sup>st</sup> century skills and competencies will intersect between the understanding and use of information and communication technology, but also as critical thinking, communication, creativity, and life and career skills.

## Chapter 2: An Overview of Digital Literacy in Education

This chapter will provide context for the wide range of topics discussed in this thesis. These topics include digital literacy, teacher and student engagement with new technologies, how technology could be integrated into the Ontario classroom, and the importance of the non-formal learning environment in the 21<sup>st</sup> century. It is important to note that Media Smarts has been referenced extensively, mainly because the information gathered is comprehensive and innovative, but also because there is a lack of Canadian-based educational research on digital literacy. First, a definition of digital literacy is gathered from several sources which date back to the term's inception. The sections that follow place digital literacy in the context of the classroom through the vantage point of the student and the teacher, but also from a macro perspective that analyzes technology as pedagogy and the process by which it is integrated into the classroom.

### Defining Digital Literacy

The term Digital Literacy was popularized by Paul Gilster and he places great emphasis on meaning, interpretation, and critical thinking. Digital literacy is not just about understanding how to use computers or technology; it is a much more complex way of thinking that is rooted in semiotics. The field of semiotics teaches us that we must interpret messages and study the signs that we encounter, we must deconstruct intended messages, while maintaining a critical lens on the medium from which it was delivered. To elaborate, Gilster provides a definition of digital literacy that is worth quoting at length (Gilster, 1998):

*the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers. The concept of literacy goes beyond simply being able to read; it has always meant the ability to read with meaning and*

*to understand. It is the fundamental act of cognition. Digital literacy likewise extends the boundaries of definition. It is cognition of what you see on the computer screen when you use the networked medium. It places demands upon you that were always present, though less visible, in the analog media of newspaper and TV. At the same time, it conjures up a new set of challenges that require you to approach networked computers without preconceptions. Not only must you acquire the skill of finding things, you must also acquire the ability to use these things in your life. (pp. 1-2)*

To elaborate, it is important to understand that digital literacy is not just applicable to modern technologies. Digital literacy can be explored through newspaper, television and the radio. This is an important distinction, mainly because schools are often at a financial disadvantage when it comes to teaching digital literacy with modern technology, especially when compared to institutions like the DMA. We learn from Gilster that digital literacy skills can be taught with older, less expensive technologies. Learning how to interpret messages in our digital world is at the heart of being digitally literate and we do not always need cutting edge technology to get there.

Gilster provides us with a solid foundation upon which to build as we come closer to understanding the scope of digital literacy in the 21<sup>st</sup> century. As we move from traditional media, to a new form of media, Renee Hobbs provides us with a reimagined idea of digital literacy's breadth in the 21<sup>st</sup> century when she says, "Digital literacy is associated with the ability to use computers, social media, and the Internet" (p. 17). Hobbs focuses on specific modern technologies, some of which go beyond Gilster, and highlight newer forms of media that are relevant to this manuscript. To bridge the gap between Hobbs' modern expansion and Gilster's traditional definition, digital literacy can also be understood as a set of skills central to cultural, civic, and economic participation (Aabo, 2005). This type of digital participation can be

attributed to network advancements like Web 2.0 tools. Since the introduction of Web 2.0, “a participatory culture has emerged, requiring skills for expressing, creating, sharing, interacting, and engaging” with digital media (Meyers, Erickson, & Small, 2013). We can understand digital literacy as having a strong connection to society, not only from the perspective of users consuming and accessing information, but also by creating it. We can think of the societal connection between digital literacy and content creation as a problem-solving methodology. In a hierarchical sense, we can view the peak of digital literacy as a process of creating solutions to societal problems. Interpreting digital literacy as a problem-solving strategy brings meaning to its impact on education and our world.

In order to conceptualize digital literacy and its variety of competencies, Media Smarts (2015) provides us with a visual that encompasses the aforementioned ideas of digital literacy. Media Smarts’ longstanding mission to enhance digital and media literacy has a positive impact in the lives of educators, students, parents, and schools. Media Smarts provides us with a framework that clearly outlines and describes what it means to be digitally literate in the 21<sup>st</sup> century:

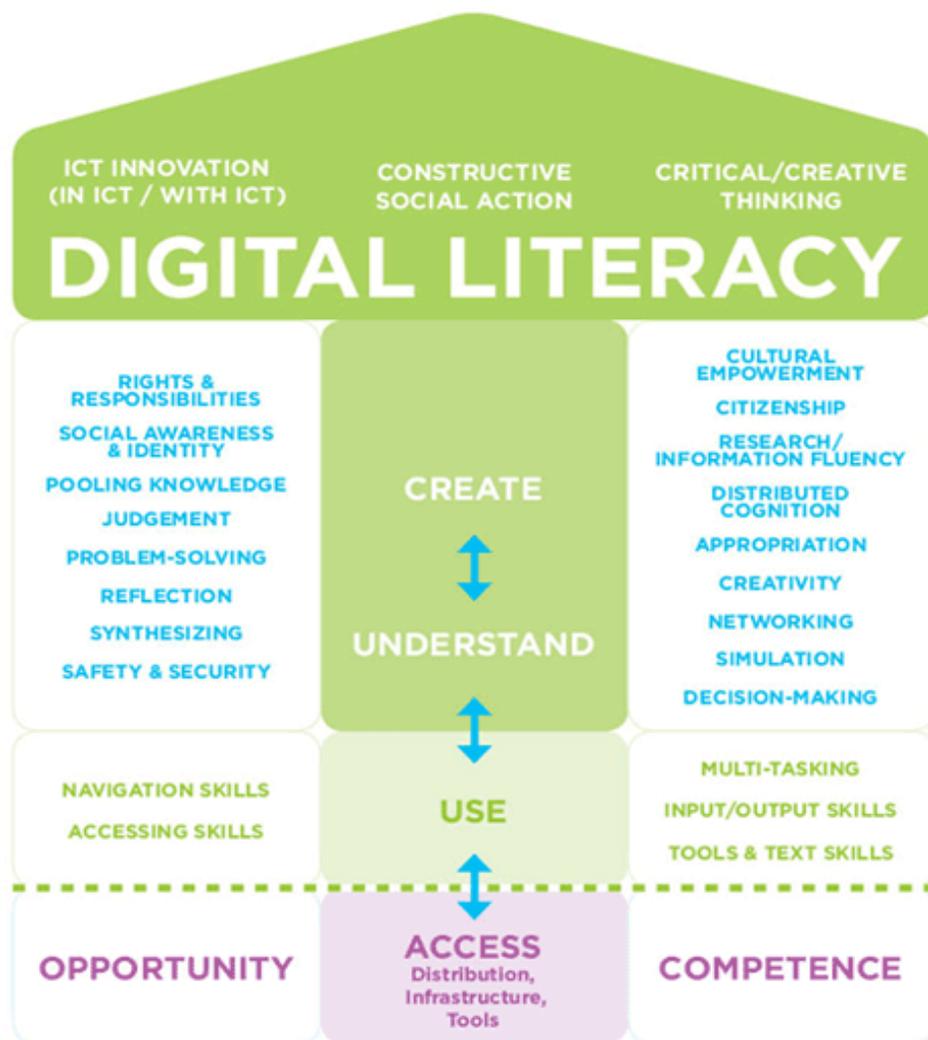


Figure 1. Digital Literacy Model

Media Smarts separates digital literacy into three categories; Information Communication Technologies (ICT), Constructive social action, and Critical/Creative thinking. This image helps clarify that *access* and *use* are only small portions of what it means to be digitally literate. As it stands, our students may be learning independently how to access and use a variety of new technologies through their experiences inside and out of the classroom. In order to teach digital literacy effectively, our teachers must be prepared to explore the competencies required to understand and to create content in our digital world. In order to

make digital literacy meaningful outside of the classroom, we must find ways to teach our students to create with purpose. Purposeful creation can be rooted in problem-based solutions. In order to create digital communications for a purpose, a problem must be identified, followed by a proposed solution. It is not enough for students to flood digital spaces with entertainment-based creations, even though this does serve a purpose in youth culture (Jenkins, 2009). Instead, it is important that students are taught how to create in digital spaces for the purposes of civic engagement and digital citizenship.

The first step required to achieve true digital literacy begins with *access*, which also aligns itself with the *opportunity* and *competence* sections in Figure 1. This appears to be a simple and elementary beginning. In this model, it would make sense that one would need the distribution, infrastructure, and tools before he or she could use, understand, or create content in a digital world. The simplicity of this beginning should not be overlooked or taken for granted. In a society that is increasingly more digital, we see disparities in learning potential across Canada. Specifically, the gaps between the technology “haves” and “have not’s” is a real problem in Ontario and the digital divide shall be an underlying consideration throughout this thesis (Sciadas, Statistics Canada, & Science, 2002). It is important to remember that the learning potential that is delivered through digital interaction is not always accessible in students’ homes or schools. It is equally important to understand how to teach the variety of digital literacy competencies without the latest and greatest technology. Although this situation is not ideal, digital literacy can be taught with very low-level technology. Ontario students do not need the newest virtual reality cameras to understand the implications of a new reality, nor do they need a 3D video game development software to understand the cultural and societal

implications of male-dominated video game characters. Teachers can prepare their students for our digital environment by giving them the appropriate skills to think critically about the media with which they will undoubtedly be engaged with in the future. Teaching digital literacy on a budget is not a futile approach and it is important to understand that teachers can empower Ontario students without expensive robotics kits, 3D printers, or the latest digital film equipment.

**The purpose of this section was to highlight and review the Access, Use, Understand, and Create model from Figure 1:**

- Access – to have convenient and fluid access to networked technologies;
- Use – to use modern technologies with a degree of skepticism;
- Understand – to understand technology with a degree of critical detachment;  
and
- Create – to create digital content with meaning and purpose.

### **Teacher Engagement**

The use of digital technologies in the classroom is not a new concept and we can look to television as a precursor to newer forms of digital media, although the use of technology can be traced back much further to analog media like the radio. Popular television shows were once used in classrooms because of their tremendous popularity outside of the classroom. *Sesame Street* is an excellent example of television as a medium that delivered popular culture to pre-school children and students in the elementary school system. Teachers and administrators identified *Sesame Street's* popularity and attempted to use it for educational purposes in the classroom (Hoechsmann & Poyntz, 2012). The use of digital media as an educational pedagogy

is currently widespread, but “evidence about the learning value of much of this media remains in short supply” (Hoechsmann & Poyntz, 2012, p. 52). School boards and policy makers continue to value and view modern technology as essential pedagogy in the classroom; but its overall learning value and potential has not been clearly established in research. In 2012, a pilot research study assessed local innovation goals for 46 school boards in Canada and discovered that many school boards are aware of the impacts new media are having on education, but are having a difficult time establishing unified goals and addressing the challenges of a rapidly advancing technological landscape (Beggs, Shields, & Bernard, 2012). New media are certainly growing more popular in schools, and it is becoming hard to ignore this shift, especially when examining the host of teaching technologies used in classrooms today, like laptops, smartphones, tablets, Chromebooks, and Smartboards.

Although there is a wide range and number of modern technologies present in Ontario classrooms, there is little doubt that some teachers are having a difficult time implementing them into their daily instruction (Johnson, Riel, & Froese-Germain, 2016). A large component of teacher resistance or reluctance to incorporate technology in the classroom stems from the idea of the *Digital Native* and the *Digital Immigrant* theorized by Marc Prensky (2001). Prensky refers to the digital native as a person who grew up with technology and has a level of innate knowledge, skill, and competency that digital immigrants simply do not have (Marc Prensky, 2001, p. 2). The digital native speaks a different language; one that involves an entirely new vocabulary that evolved through experience with computers, video games, and the Internet. The digital immigrant is a person who was exposed to modern technological advancements

later in life. The popular belief that has arisen from Prensky's work is that the digital immigrant simply cannot keep up with or understand the evolution of digital language and practices.

Media Smarts conducted a national survey of Canadian youth and assessed the role that networked technologies play in their lives (2014). The study included every province and had a sample size of 5,436 students from grades 4 through 11. The report discovered that 24% of students in grade 4 have their own cell phones, compared to 52% of grade 7 students, and an astonishing 85% of grade 11 students (Steeves, 2014). With each cell phone connected to the Internet, whether through a data plan or Wi-Fi, we can comfortably say that our youth have the potential to stay connected during every waking moment of the day. The study also revealed that 99% of students in Canada have access to the internet outside of school, with only 6% reporting that they rely on public libraries and community centers to connect.

It is clear that youth are no longer limited to a shared desktop computer in one room of the home. Most youth have never experienced dial up internet; their connections through Wifi give them nearly instantaneous access to information much faster than they could ever consume. Thus, on the surface it is easy to assert that today's students have far more experience with technology at their age compared to what many teachers had at the same age. In order to overcome the perceived technological barriers with which teachers - as digital immigrants - are faced, we must look more closely at the ideas presented by Prensky (2001) and compare them to the *access, use, understand, and create* model presented in Figure 1. There is certainly some objective truth behind Prensky's theory; however, there is a logical fallacy embedded in it, the misconception that children, given their access, are effectively using technology. They may very well be proficient at accessing and using digital technology, but

there is a large difference between knowing how to navigate a piece of technology and truly understanding its potential for communication and learning.

It is hard to ignore the supposed implications of Prensky's theories on the dynamics that are found in many Ontario classrooms. With each passing year, grade school teachers are being encouraged more and more to integrate communication technologies in to their teaching while those technologies and the latest ones the students are using keep changing. Within the model outlined in figure 1, we can identify what our students may need, and in turn, identify Ontario teachers' role in the process. The digital native and digital immigrant should represent more than just navigation skills, multi-tasking capacities, and text creation skills. Some things have to be taught. It does not come naturally to understand one's rights and responsibilities as online users, to demonstrate proper judgment and social awareness, and to create texts for the purposes of personal and cultural empowerment. A teacher that lacks confidence should remember that he or she offers a wide set of skills that could help a student appropriately navigate technology within the classroom in a meaningful way. Teachers must continue to guide and empower our students to think creatively and critically about the technologies with which they are engaged. It is the responsibility of the teacher, whether he or she identifies as a proficient user or not, to (Freire, 2005):

*know what happens in the world of the children with whom they work. They need to know the universe of their dreams, the language with which they skillfully defend themselves from the aggressiveness of their world, what they know independently of the school, and how they know it. (Freire, 2005, p. 72)*

## **Student Engagement**

Schools across Canada are incorporating a variety of technologies in their classrooms;

mainly as tools for students to use so that they can access information online (Johnson et al., 2016). It is important to know which types of technologies Canadian students are using and the Canadian Teachers' Federation partnered with Media Smarts to determine which technologies and media were being used most frequently. They surveyed 4,043 K-12 teachers and school administrators who assessed teachers' relationships with networked technology in their classroom and how technologies impacted their teaching practices. The survey found that schools in Canada are making use of Blogs, Micro Blogs, Videos, Podcasts, Digital comics, and video games to teach a variety of subjects. The following chart, taken from the report, depicts the in-school relationship that students have with modern technologies in Canada. When looked at closely, the Videos category has the highest access point among students in the classroom.

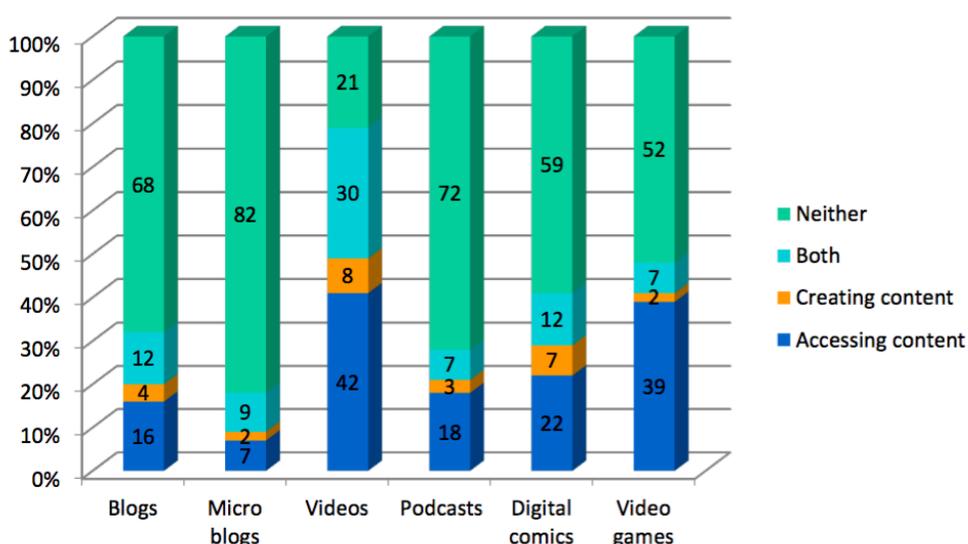


Figure 2. Type of Student Engagement: Various learning platforms

Ontario students are consuming and exploring a large quantity of information through video-sharing platforms as consumers but also as new media producers. It is clear however that

students are accessing videos in the classroom more often than they are creating them, but not by much. In the video category, only 8% of teachers report that their students are learning how to create content in the classroom through video expression but 42% of teachers report they are accessing and creating content through videos (Johnson et al., 2016). It really comes as no surprise that students are accessing content slightly more often than they are creating it, mainly because the technological infrastructure to create videos in the classroom is a far more in-depth and costly process than to watch videos on the desktop computer or Smart Board. What is most pertinent and worrisome about the research collected from this survey is that more than half of Canadian teachers said they were not using any of the digital platforms highlighted in the survey. These numbers raise many questions about the quality and frequency of digital literacy being taught in K-12 classrooms.

Today in Canada, Johnson et al identified the five most important digital literacy skills that our students must possess (Johnson et al., 2016). Those five skills were collected through a survey performed by the Canadian Teachers Federation and Media Smarts. The following 4,043 K-12 teachers identified:

1. Staying safe online,
2. Appropriate online behavior,
3. Dealing with cyberbullying,
4. Understanding online privacy issues and settings, and
5. Verifying that online information is credible/relevant/accurate.

These five skills are undoubtedly very important for students in Canada. From an in-school perspective, maintaining the safety of students is a primary concern and the digital society has

made them susceptible to a new wave of privacy and bullying issues. These five skills are however, only a component of digital literacy and in order to effectively teach students to be digitally literate in the way outlined in figure 1, we should also teach them to create media for the purposes of cultural empowerment. Although young people are using digital media in formal and non-formal learning environments, it should not be assumed they are digitally literate. Students frequently create and use information through networked technologies, especially from the home. If students were given instruction by their teachers to create online media with the intent to create media for a specific meaning and purpose, they could teach all five of Johnson et al.'s (2016) important digital literacy skills through the process of creating media. Teachers must harness their students' creative energies to engage students in a broader range of cultural and civic experiences that support their intellectual, cultural, social, and emotional development in order to achieve digital literacy (Hobbs, 2010).

In 2005, Pew Internet and the American Life Project interviewed 1,100 teens aged 12-17 across the US and found that 57% of all American teens who use the internet are *content creators* (Lenhart & Madden, 2005). A content creator is someone who uses networked technologies to create blogs or webpages, shares original and creative content, or remixes what he or she finds online into something personally expressive (Lenhart & Madden, 2005). This study is over a decade old and technology has changed and evolved since then; especially considering the evolution of mobile devices. To provide a point of reference, Steve Jobs announced the first-ever touch screen phone in 2007 with the release of the *iPhone* (AppleKeynotes, 2007). Newer forms of media creations like memes, podcasts, and social networking sites like Instagram and Snapchat provide teens with ample opportunities for

content creation and expression. Students are no longer only consumers of new media. In fact, “we are moving away from a world in which some produce and many consume media toward one in which everyone has a more active stake in the culture that is produced” (Jenkins, 2009, p. 12). In order for Ontario students to participate in cultural expression through production, they must create. Students are increasingly creating for the purposes of consumption in the non-formal learning environment. A student who documents his or her time at a baseball game through a social networking site may create or remix images, selfies, or videos, and do so with the intent that others will consume it. It is important that teachers harness this form of expression and help students develop a wide range of skills that inspire students to create content, not just in the non-formal learning environment, but inside the classroom as well.

One of the components of the participatory culture Jenkins (2009) outlined is to seek the support of a mentor, where the sharing of information and experiences can be disseminated between novices and experts (Jenkins, 2009, p. 6). The teacher and student are perfect examples of the novice and expert, or to use an earlier distinction, the Native and the Immigrant. The role of the novice and expert may overlap in that a teacher may be an expert in some things and a novice in others; likewise, a student may be a novice or expert depending on the learning situation. An important component of the participatory culture is an exchange by which the teacher or student help one another understand the process of creating digital content. Despite the lack of digital content creation in many traditional learning environments, many students are engrossed in content creation outside of the classroom. This is not to say that there is no place for this type of work in the classroom, but instead that the classroom should, undoubtedly, be a place for exploration and explore this type expression and creative

thinking. It is understood that media education in the classroom can be highly technical, and somewhat complex in nature. The complexities of media education can arise from changing social, economic, and cultural contexts. Catherine Burwell (2010) believes that educators would benefit from viewing “such conflicts and contexts... as crucial starting places for critical inquiry and imaginative production practices” (Burwell, 2010, p. 396). In conjunction with the higher-level concepts of digital literacy expressed in Figure 1, the teacher can and should guide students towards a form of content creation that is meaningful and purposeful. Our teachers must bridge the gap between the non-formal entertainment-based creations and the formal classroom, which should aim to teach purposeful and meaningful content creation.

### **Technological Infusion**

The Canadian federal and provincial governments have worked towards developing more digitally infused classrooms. The SchoolNet initiative was launched in 1993 and was designed by the federal, provincial, and territorial governments to make Canada a more digitally connected country (Darragh, 2012). The primary focus was to connect all of Canada’s 16,500 schools to the internet and develop a website featuring educational content that could be accessed by Canadian schools. Between the years of 1996 and 1997, the website had over 2.5 million visitors per month (Darragh, 2012). More recently, in the summer of 2013, the Minister’s Student Advisory Council met to brainstorm about the future of education in Ontario. A sketch was created to highlight the outcome of their brainstorming session; the sketch featured ideas about individualized learning, practical application, peer mentoring, technology, and cultural literacy (Fletcher, 2013). To highlight the area most pertinent to this thesis, the following image was captured:



Figure 3. Students Imagine the Future of Ontario's Education System

This image highlights some of what the Student Advisory Council believed to be important practices for integrating technology in the classroom. Much of what they highlighted involves the access portion of the digital literacy scale (Figure 1). This includes making EQAO available online, making school documents and resources available online, and providing more online support. Other ideas stem from game-based learning or to gamify learning. These ideas highlight students' desire to exercise agency and control in their learning. Games, as opposed to textbooks, encourage students to be producers of text, not just consumers; they can be "writers", not just "readers" when interacting with technology (Gee, 2005). This idea highlights the crucial distinction between reading a resource on paper, versus reading it on an iPad. The difference between being what Gee calls a "reader" and a "writer" is not particularly different whether reading on paper or on an iPad. However, if a student were to gamify his or her learning experience, there would be greater opportunity to teach a wider set of digital literacy competencies. The aim of this thesis is to describe the benefits of digital technologies as tools

for production; and this perspective mirrors the benefits of games in relation to textbooks. To make a digital to digital comparison, creating through technology provides a much more in-depth learning experience than only learning how to use technology critically and safely.

Students and teachers in Canada, both at the elementary and high school levels, have been using networked technologies in the classroom since the 1993 SchoolNet initiative. Smart Boards and Desktop computers are the most popularly used technologies in Canadian classrooms today and many teachers report they are quite comfortable using them (Johnson et al., 2016). What is less clear, is whether or not teachers are utilizing these technologies to their fullest potential. A trustee from the Lambton Kent District School board explained the importance of digital literacy and its place in the classroom when he said, “Teachers need to change the culture of education and infuse it with the same technologies for learning that our students use for living” (Ontario Public School Boards Association, 2009). This is an incredibly powerful statement and describes technology as a window into the rest of students’ lives. If we could find ways to harness our students’ obsession with digital technologies and steer much of their efforts away from entertainment-based digital production towards powerful and transformative production, we could extend student learning beyond the classroom and bring deeper meaning to digital interaction.

There are many factors that contribute to the effective integration of technology. The purpose of this thesis is not only to identify how to use digital technology in the classroom, but how to use it for the purposes of meaningful creation. First, an assessment of technological integration from the perspective of the teacher is required. The Technology Acceptance Model (TAM; Davis, Bagozzi, & Warshaw, 1989; below) outlines a variety of check points that a piece

of classroom technology should pass before it is fully adopted into the classroom. TAM was chosen for my research because it is the most commonly used and foundational model of technology integration (Adams, Nelson, & Todd, 1992; Lee, Kozar, & Larsen, 2003; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

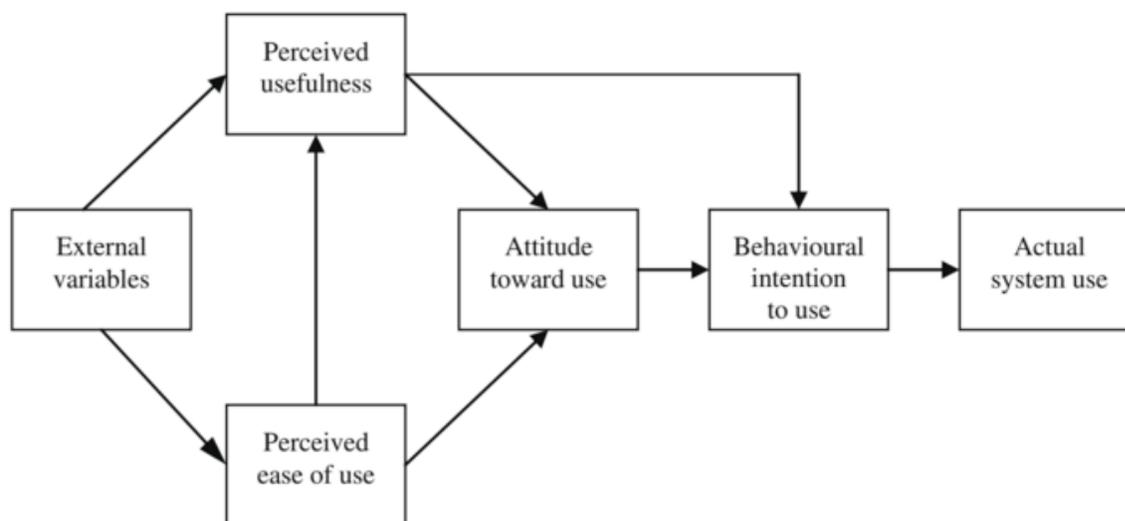
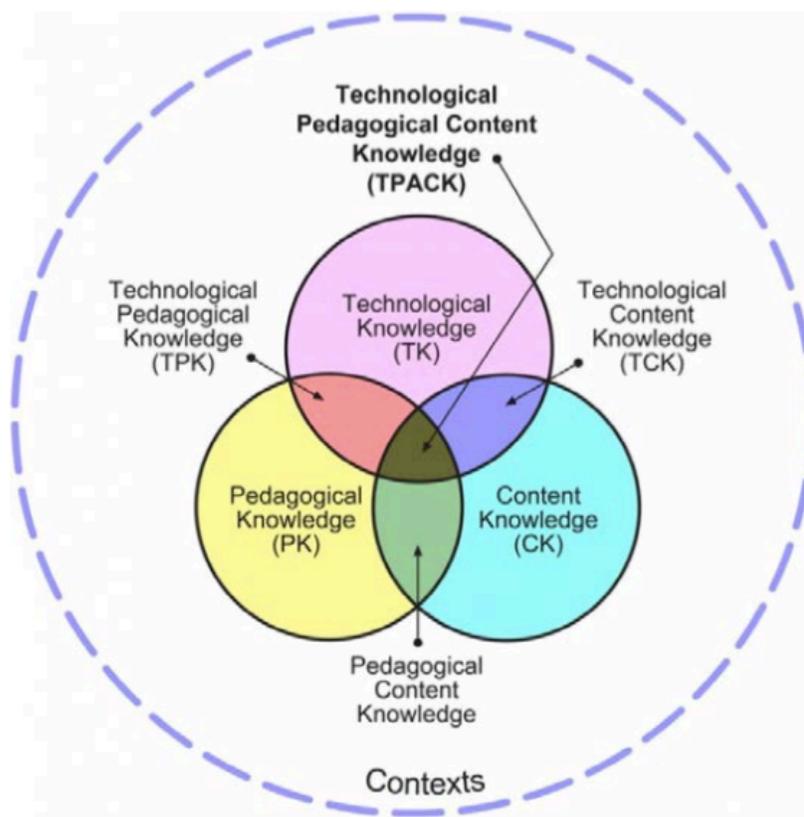


Figure 4. The Technology Acceptance Model (Davis et al., 1989, p. 985)

Some variables examined in the TAM are factors external to the classroom. The external variables include cost, accessibility, and a desire from a policy level to include technology. In this thesis, the external variables are analyzed in less detail because we know that schools have already adopted a variety of pieces of technology. Perceived usefulness and perceived ease of use are the two major components of technology integration in our schools (Fathema, Shannon, & Ross, 2015). Schools in Canada generally accept and make use of technologies that already follow the existing makeup of the classroom. As an example, the Smart Board was widely adopted because of its resemblance to the chalk board and white board (Beauchamp,

2004). Teachers, administrators, and policy makers were able to accept this piece of technology as useful because the classroom was already accustomed to a central writing board. Some newer forms of technology, like the EV3 robotics kits by Lego and games like Minecraft are slowly being integrated into some classrooms; but only in the schools that already have a positive attitude towards the technology (Davis, Bagozzi, & Warshaw, 1989). In most cases, the schools using these less orthodox forms of technology are doing so independently and are not directed to incorporate them by administrators or policy makers. In these cases, where the perceived usefulness is high, there are positive attitudes from teachers in the school to implement the technology. Davis et al.'s TAM model (1989) helps to explain why some schools have implemented digital technologies for the purposes of creation and why some have not.

Incorporating digital technologies in the classroom goes beyond perceived ease of use and perceived usefulness. It is not just about attitude and behavior, but also about knowledge and experience with certain technologies. Mishra and Koehler (2006) identify a framework that addresses appropriate and meaningful technological integration in the classroom to support pedagogy. This framework draws upon a variety of classroom practices and views technological integration as a three-part collaboration. This framework is an extended version of Shulman's PCK framework, which looked specifically at content and pedagogical knowledge (Stoilescu, 2015, p. 517). Mishra and Koehler's TPACK model includes Technology, Pedagogy, and Content Knowledge (Mishra & Koehler, 2006).



*Figure 5. TPACK Model*

This model demonstrates how complex it is for a teacher to appropriately and effectively integrate technology into his or her classroom instruction. Content knowledge is a component with which most teachers will be comfortable, especially if they are veteran teachers. What becomes more complex and difficult for teachers is having the technological and appropriate pedagogical knowledge for using technology effectively. Teachers must understand how to use technology before they can implement it into their classroom instruction and in order to do this, they must also find ways to use technology as pedagogy. The problem with this model is that it lacks specificity regarding degrees of knowledge in each area and therefore can lead teachers and administrators to feel confident in their content, pedagogy, and technological

knowledge. After all, uploading a worksheet to a Chromebook is a digital practice, though limited, that could lead teachers to feel as though they have the technical, pedagogical, and content wherewithal to consider themselves effective and innovative teachers. This model is used in this thesis primarily to demonstrate the three facets of technological infusion.

### **Non-Formal Learning**

The purpose of this section will be to explore non-formal learning environments with the intention of highlighting its role in educating young people. To define the term non-formal learning for this thesis, it can be considered any camp, academy, or institute that focuses specifically on specialized digital literacy instruction.

Non-formal learning is a term that helps describe the learning that happens outside of the traditional classroom. This term encompasses a wide range of structures that are privately funded and dedicated to student learning. The non-formal learning sector is summarized as a vast range of privately funded structures that are dedicated to a wide range of activities and disciplines that follow a curriculum but do not lead to publicly recognized credentials (Werquin, 2009). In relation to non-formal learning, formal learning is more widely accepted and is recognized as an important rite of passage into the work force; like progression from one grade to the next or receiving a diploma or degree. In contrast to the traditional classroom, the non-formal learning environment often provides specialized or focused learning opportunities for its participants. The benefits of this environment can, and often do, provide a type of learning that is not easily found in the traditional K-12 classroom. To provide a more specific example, a student that has a vested interest in robotics or Lego would gain some exposure to these in the best of classrooms but would get much more exposure and experience if he or she enrolled in

Lego's Education Academy, as an example.

The Government of Canada is working towards building a “world-class digital economy... [and] it is essential that all Canadians have the skillsets to be able to access, use and interpret a growing and increasingly complex range of digital information” (Government of Canada, n.d.). The success of our economy relies on having a digitally competent population and there are a wide range of obstacles that are preventing us from achieving this level of competence. The three biggest obstacles, or factors, contributing to the digital skills gap, are age, education, and income (Government of Canada, n.d.). As Canada works towards developing the infrastructure needed to reach digital competence in the workplace, many parents, students, and teachers are looking elsewhere to develop them. The Ontario classroom makes use of some digital technologies but the level of teacher experience varies and the quality of instruction lacks consistency. For these reasons, many parents and students are looking to the non-formal learning sector for assistance in developing skills for the digital world and the digital economy.

It is incredibly important that Ontario classrooms offer the practical experiences and skills needed to be successful in the workforce. Since many classrooms do not offer these opportunities, many parents enroll their children in non-formal learning environments to take advantage of opportunities to develop practical skills beyond what the school may have to offer. The popularity of camps like the Digital Media Academy demonstrate parents' desires to educate their children outside of the traditional classroom. DMA is not a typical unstructured summer camp filled with outdoor sports or games; it runs very similar to a university or college. Each classroom has an instructor and a teaching assistant and the majority of the content covered in the teen courses resembles a first-year university course. DMA is an

academy that transcends the boundaries of the traditional classroom with its advanced curriculum and course materials.

The non-formal learning sector offers what Ian Connell and Geof Hurd would call, *critical vocationalism* (Goldfarb, 2002). Critical vocationalism expresses the idea that skills need to be carefully and critically developed in order to gain employment later in life (Hoechsmann & Poyntz, 2012). In DMA's case, parents carefully select the skills they believe their children will need later in life and enroll them into the corresponding course. It is important to note that the non-formal learning environment is not always so carefully selected based on vocationalism. Courses and programs can be selected based on general interest, enthusiasm, and motivation, but also "along an emotional axis in terms of their relationships with others, especially adults" (Sefton-Green, 2013). The learner is motivated and enthusiastic because there is an element of agency or choice in the non-formal learning environment that may not be the focus of the formal learning setting. Some students may also be driven to this form of learning environment because they lack emotional connectedness or support at home and are looking for support and security in a setting that is curated on the basis of mutual interest. A child's relationship with his or her parents can also affect the type of program he or she enters for learning. In many cases, programs are selected based on cost, geography, time, and convenience, which is ultimately in the hands of the adult registering and paying for their son or daughter to attend.

### Chapter 3: Research Methods

After spending the 2015, 2016, and 2017 summers as the Program Director at the DMA, I discovered many new and exciting ways to use technology to support learning. This new style of learning was not part of my previous experiences as an educator or in my undergraduate degrees. The Oculus Rift, a variety of 3D printers, EV3 robotics kits, computer programming software and advanced film equipment were presented in educational contexts. The cost of this equipment is incredibly high and that is reflected in the cost for campers. The technology used in each classroom is not likely accessible to a formal Ontario classroom; however, the methods and strategies used at the DMA could be adapted to the formal learning environment of Ontario schools. This rationale led to the current qualitative study that aims to uncover a variety of digital literacy strategies that could be situated into an Ontario classroom. Qualitative research is “an umbrella term covering an array of interpretive techniques which seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world (Van Maanen, 1979, p. 520). This definition, although somewhat dated, describes the approach to this study which aims to make sense of new digital literacy teachings within the context of the Ontario classroom. As a result, an ethnography aimed to make sense of the teaching and learning at the Digital Media Academy. An ethnography report “refers to the various ways different groups go about their lives and to the belief system associated with that behaviour” (Wolcott, 1999, p. 22). In this case, the belief system originated from the Silicon Valley area of California where the DMA headquarters resides. This technology hub of the world provides an innovative perspective to education that will likely trickle across the US and eventually into Canada. This

study shares insights into how modern and cutting edge technologies are being used in Silicon Valley and it begins a conversation about the integration of a digital literacy program in Ontario schools.

### **Researcher Positioning and Bias**

My position as Program Director at the University of Toronto DMA location provided insights and access that an outsider may not have been granted. As Program Director, my capacity does not intersect with curriculum development or instruction and I spend more time working with instructors, teaching assistants, parents, and corporate level staff than I do working with course content. This working capacity has given me some insight into the learning potential of digital literacy instruction, but my interaction with the students and the technology is removed enough for me to approach the interviews with an open and objective mindset. My role as Program Director does not have any direct impact on the role of any curriculum staff members. My insider position should be viewed as a benefit to this thesis because it has provided me with access to authentic and innovative insights that would not have been granted to an outsider. It is also important to note that the curriculum at the DMA is highly valuable and would only be entrusted with staff members within the organization.

### **Participant Interviews**

A semi-structured interview approach with eight curriculum staff from the Digital Media Academy occurred between December 14, 2016, and February 1, 2017. The interviews ranged from 25 to 50 minutes. The curriculum staff were invited to participate as interviewees because of their critical insight into the curriculum and instructional design of the entire DMA program. In recent months, the DMA curriculum has been sold to the National Aeronautics and Space

Administration (NASA) for their Robotics Alliance Project and this speaks to the comprehensiveness and quality of the curriculum at the DMA. In order to yield the greatest and most diverse perspectives on digital literacy instruction, a semi-structured interview process was designed. It is important to note that all interviews were conducted through two-way online video chat platforms like Skype (Microsoft Inc.) and Google Hangouts (Google Inc.). As noted in the following section, the DMA curriculum staff selected for this study lived in various locations across the US. The semi-structured interview method was chosen over structured interviews because “all questions were used flexibly” and there was no predetermined “wording or order” so that the emerging themes could unfold as organically as possible (Merriam & Tisdell, 2015). The questions used for the interview process were designed to be open ended and to yield the most authentic perspectives possible on a variety of digital media contexts. The interview questions were not always asked in order, and in most cases, probing questions that deviated from the written questions were used to dig deeper into insights that were unforeseen. The seven core interview questions read as follows:

1. What are the 3 most important digital media skillsets?
2. What are the 3 most important digital media competencies?
3. Your pedagogy can be described as production oriented. What is it about content creation that is so important for the campers’ learning experience?
4. Do you think good digital media pedagogy depends on the use of current technology that is less than 2 years old? Explain
5. Do you consider aligning what students are learning in the school system with the curriculum offered at DMA? If so, how?

6. What knowledge and abilities that the students bring from elsewhere impresses you most? Is it primarily learned from do it yourself (DIY) learning or formal learning contexts such as the school?
7. Do you think that the lessons contained in the Learning Management System (LMS) adequately prepare your instructors to teach students?

### **Participant Selection**

The curriculum developers at DMA were selected following a purposeful sample that aimed to have maximum variations between disciplinary content. The backgrounds of each developer varied, and in many cases, the developers also worked at the DMA in another capacity. Many of the curriculum staff worked as Regional directors, instructors, or directors of specific camp locations. The following table depicts some developers' day jobs or past experiences with digital literacy content. Peggy, Dave, Marcus, Shane, and Paul are full-time DMA employees, while Sara, Evan and Trevin work for the DMA in a part-time capacity. The DMA has staff members that stretch across the US and Canada, and their curriculum instruction team often works remotely through a dedicated online platform. The following table depicts the curriculum staff names, without the use of pseudonyms as indicated in the written consent forms, as well as his or her current role with DMA, and his or her previous or current experiences with digital literacy content.

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*Table 1. Names, Positions, and Previous Experience of Interview Participants*

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<b>Name</b>	<b>DMA Position &amp; Location</b>	<b>Previous Experience of Interview Participants</b>
Peggy	DMA Curriculum Developer, Made By Girls Lead & Regional Director (Stanford)	Grace Hopper Conference presenter and advocate for Made By Girls Scholarship program
Dave	DMA Director of Curriculum & Instruction	Former media arts teacher and trainer for Apple Education
Marcus	DMA Assistant Director of Curriculum & Instruction	Former Graphic Designer
Shane	DMA Assistant Director of Curriculum & Instruction	K-5 Curriculum developer at Big Thinkers (Atlanta, Georgia)
Paul	DMA Curriculum Developer & Regional Director	Former High School Teacher & Administrator (Austin, Texas)
Sara	DMA Curriculum Developer & Program Director	STEM Enrichment Director at Minnesota Science Academy
Evan	DMA Curriculum developer, Instructor & Assistant Director (Harvard)	Robotics Consultant – ConnectTel (Austin, Texas)
Trevin	DMA Curriculum Developer & Instructor	Full time Lead Game Developer at MindBlown Labs (Oakland, California)

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### **Risks and Benefits**

There was no known risk associated with participation in the research. There were no direct benefits to participate in this research. The benefits to the participants were intrinsic, a sense of fulfillment for giving back to the field of Education, as well as promoting their brand. The results of these findings may also provide the developers with new insights on how to connect the specialized digital literacy curriculum to the formal classroom. The potential

societal benefits are also substantial; the findings could contribute to the development of new digital literacy practices and pedagogies in school communities.

### **Data Analysis**

The audio from the interviews was recorded using an iPhone and later transferred to a closed iTunes playlist for transcribing. During the interview process, a handwritten document was created for each interviewee that had three sections titled, Time, Theme, Question. This categorization allowed themes to reveal themselves organically throughout the interview process. As new perspectives emerged from the interview, a time stamp was written down so that I could go back and listen to specific sections of each interview in detail. The times coincided with a prospective theme, as well as the question asked of the interviewee. The themes were generated through a process of uncovering the different facets of a comprehensive digital literacy program. The ethnographic study aimed to combine the variety of themes to provide an overview of the most important and innovative components of digital literacy instruction. The themes that were documented were related to education contexts and included a variety of skills, competencies, or approaches. The interviewees were very forthcoming and allowed for further explanation of a specific term when asked.

After all interviews were fully transcribed into a Google Doc, a comparative analysis was performed. The highlight and comment functionality within Google Docs allowed for side-bar comments that were categorized into themes. Once all pertinent themes were discovered from each transcript, all documents were printed and reviewed simultaneously. The themes that recurred as either opposing or congruent perspectives were categorized in six different themes. The infrequently used themes that were mentioned by three or fewer developers were left out

of the analysis. The six themes that were uncovered for the interview are discussed at length in the following chapters.

## Chapter 4: Extracted Themes

The eight interviews yielded six themes that encompass a variety of digital media skillsets and competencies the participants felt were needed in the 21<sup>st</sup> century. The backgrounds of each developer provided unique perspective and a diverse approach to challenges regarding digital literacy. The following themes emerged:

1. Computer programming is a primary digital media skillset
2. Digital Media is a vehicle for expressive thoughts and emotions
3. The DMA focuses on content creation when teaching digital literacy
4. New and expensive technologies are not necessary to teach digital literacy
5. Digital media disciplines should have a human centered design approach
6. Digital media disciplines teach students to have a growth mindset

The six main themes and related subthemes are described in detail in the following sections. The themes that are divided into several subthemes represent the variety of different perspectives represented by the interviewees.

### Theme 1: Digital Media Skillsets

Throughout the course of the interview process, a variety of Digital Media Skillsets were discussed. The question was framed so that participants would select their top 3 skillsets that they believed were the most important among the variety of disciplines offered at DMA. The eight DMA curriculum team members provided a wide range of perspectives that were undoubtedly shaped by their experiences with and outside of DMA. Although there was only one dominant skillset mentioned by the participants, it is still worthwhile to discuss the similarities and differences amongst the participants' perspectives.

*Primary skillset: programming.* One skillset that emerged most often included computer programming and computer science. Peggy Lee and Dave Livingston were the only two participants that did not rank programming as the number one skillset, mainly because their focus was rooted in the competencies and transferable skills that a variety of disciplines at DMA offered, and these will be discussed in subsequent sections.

Trevin York identifies an introduction to programming class as the best jumping off point when one has an interest in Digital Media. According to Trevin, learning the way a computer works, the language it speaks, and how the user can work within the confines of a programming language is foundational. Trevin explains:

I think a basic intro to programming class would be the most beneficial. Just with a basic intro to programming, students get the opportunity to wrap their heads around how a computer works, what it's built to do and I think any student can understand that, and there's really no barrier there. (T. York, personal communication, February 1, 2017)

Trevin has taught hundreds of campers at the Digital Media Academy, specifically in the intro to programming class and he believes that any student, no matter the skill level, can learn how to program. Trevin explains that:

Some students come with different levels of knowledge, and I've had students that don't know how to type because they've never had access to a computer, I've had students that were terrified of programming because of a bad experience", but after 5 days of exposure at DMA, all students leave less intimidated and more appreciative of learning how to program. (T. York, personal communication, February 1, 2017)

Evan Ryker was specific in his answer and explains that programming would be the number one skillset and mentioned Java as the most foundational language to learn. Evan explains, "the java course, to me, has always been really valuable. I know DMA has brought on

some new ones too, like SWIFT for IOS, but I still think Java is one of the most important ones (E. Ryker, personal communication, January 3, 2017). Sara Gomez also references a specific function when she says, “Programming is definitely one of them, specifically web design” (S. Gomez, personal communication, December 21, 2016). Professional web design requires a strong understanding of computer science, because professional web development makes use of HTML and JavaScript programming languages.

Paul Lopez provides context for his stance on computer programming when he says:

For the most part, I think everything is revolving and moving towards a programming based economy. In the job sector, you have to have certain skillsets, and the jobs that are paying the most and have the most available positions require programming. (P. Lopez, personal communication, December 16, 2016)

Paul believes that children should be learning to program at a very young age and schools should treat programming in the same way they treat any other subject.

**Secondary skillset: multidisciplinary.** There was some consistency in terms of the popularity of the second skillset or discipline, whereas the third skillset was scattered in terms of its popularity among participants. Paul, Sara, Evan, and Marcus believed that Engineering and Robotics would be the second most valuable skillset. Paul explained his thinking and stated:

We are moving towards a tech centric automated world, whether that’s automated cars, or automated warehouses that ship you stuff. Robotics is such a huge field, and I didn’t have that option as a student, and largely it still isn’t an option in schools. Having that option really does teach skillsets that you can’t learn any other way” (P. Lopez, personal communication, December 16, 2016).

Evan mirrored this perspective and mentioned the specific course, Arduino, which is a hands-on robotics course offered at DMA. Arduino is an electrical engineering prototyping platform that

teaches young people about electronics and how electronic circuits can work. In most cases, students at the DMA are taught to create their own remote control cars.

Trevin had a different perspective and he advocated for the design fields as his second most important skillset. Trevin thought the “design fields in general are great at getting students to think around a problem, and creatively come up with solutions and implement, test, and revise them, while constantly and iteratively getting closer to something that works” (T. York, personal communication, February 1, 2017). Trevin’s thinking was rooted in problem solving and he believed that the design process would be an excellent environment for teaching and learning to solve complex problems.

For the third digital media skillset, Marcus and Trevin found that any course, as long as it was engaging to the student, would be a great choice to develop a valuable skillset. Marcus explained, “It’s important for kids to pursue their interests and express their creativity. That could be them making a film, a song, an animation, or anything really” (M. Duvoisin, personal communication, December 14, 2016). Marcus had a specific focus on expression and creativity, whereas Trevin believed that any course would be beneficial, as long as it “pushes students outside their comfort zone” (T. York, personal communication, February 1, 2017). The rationale behind this stems from the thinking that despite how different the disciplines are, the competencies are much more transferable. In fact, Trevin explained that it would be a greater learning opportunity for a student to take a course with which they had little or no experience, rather than taking a course to which they have already had exposure.

## Theme 2: Media as an Expressive Digital Medium

Digital tools provide an outlet for young people to express themselves, remix content that has been expressed by others, and consume content others have created for an intended audience. The Digital Media Academy provides students with a safe environment where they can express themselves and showcase their creations in a space that fosters constructive feedback. Not all media produced by young people is expressive in a meaningful or thought-provoking sense and our youth are engaging in a mindless media consumer culture that is not always educational or constructive. Shane White expressed his thoughts on media consumerism when he said,

All you need to do is spend 10 minutes on Facebook and you get an idea of how many users don't know how to create content that's engaging. Just taking 5 seconds when you make something and think about how that might look to another person, and this is known to be a seriously lacking skill in many young people, and it's cool that we give them a platform to practice that. (S. White, personal communication, December 14, 2016)

There is something to be said about determining what is engaging content, but the Digital Media Academy's objective is not to create content that is engaging to the staff at DMA, but to create content that is engaging for its intended audience. Dave Livingston explains his thoughts on media and communication as a mode of reflection and feedback. Dave wants the students to "create something and present it to people, so that they have a chance to give you input on what you created, and you get the opportunity to take that input and figure out how to do it better" (D. Livingston, personal communication, December 13, 2016).

Technology as a mode of expression is not only reflected in the courses at the DMA where students upload content to the internet, but also in the robotics and wearable

technology courses. Peggy Lee provides an example from one of her Made By Girls (MBG) programs that involved a group of girls that attempted to alter young girls' hospital gowns so that they were less revealing, more expressive, and individualized. Students used 3D modelling software to create the gowns and to communicate their own style and personality. This type of purposeful expression is what DMA is attempting to foster in all of its programs.

Paul Lopez identified communication as one of the most important 21<sup>st</sup> century skills that the Digital Media Academy wishes to instill in today's young people. Paul believes that campers need to learn to communicate in media other than writing and that this should be encouraged in schools. Paul said:

I think we're all natural storytellers, and as a species we're great at storytelling. I think 21<sup>st</sup> century education has to have that continuum in another format, and that needs to continue through a student telling a story with a visual digital medium, whether that's making a video, a broadcast, or a 3D animation. (P. Lopez, personal communication, December 16, 2016)

As a Communications major, Paul Lopez views many of the programs at DMA as vehicles for storytelling and expression. Shane White mirrors this thinking and provides a specific example from one of the programming courses he taught,

A student this summer had a hard time learning the programming concepts, but once he had a few of them down, he created a series of 10 games that had intricate stories with different characters. It was less about programming for him, and more about his opportunity to tell stories. His games only took 5 seconds to play, and you only needed to jump through hoops at a certain time, but there was a whole scenario going on behind it. (S. White, personal communication, December 14, 2016)

Shane provides other examples of students in the app development courses who created their own trivia games that had an intricate and meaningful narrative, despite their somewhat simplistic and novice technical creation. Shane explains that for him, "it's less about the

knowledge they already have, but more about what they care about on a personal level” (S. White, personal communication, December 14, 2016). Many of the students at DMA require only minimal instruction in order to produce, code and express themselves through content creation. The students with even a very basic understanding can produce games that are expressive and engaging on a personal level. At DMA, the students are “not just learning to consume a product, but learning how to understand and create one” (P. Lopez, personal communication, December 16, 2016).

### **Theme 3: Digital Literacy**

The Digital Media Academy facilitates an environment that provides a variety of new and developed digital technologies for its students. Students arrive at camp and their computer, film equipment, robotics kits, and even cloud storage are provided to them. For the week that each camper is at DMA, accessibility to the newest technologies is not a concern. At DMA, students are learning to use and understand new technologies, but most importantly, how to use those new technologies as a mode of production. DMA’s production or project-based learning platform teaches students how to use and understand technology through a hands-on approach. Some participants in the study openly discussed DMA’s impact on making its campers digitally literate, but all participants discussed the components of digital literacy without explicitly making the connections. This section is also divided into three subheadings titled; Use, Understand, and Create.

**Use.** Learning to use technology requires a level of technical competence or understanding that enables students to navigate new technologies. To provide a basic example as a point of reference, learning to use a computer would require an understanding of how to

turn it on and off, switch between windows, open, close, and minimize applications, as well as knowing how to use a keyboard and mouse. Dave Livingston explains that at DMA, when developing curriculum, “you no longer have to spend a long time teaching in-application style” and this is primarily due to their previous exposure and willingness to learn (D. Livingston, personal communication, December 13, 2016). Dave was the only participant to discuss the use portion of the literacy model, perhaps because using technology is something most, if not all, campers at DMA are already capable of doing. Dave believes that many youth today are capable of using technology, but are far from being considered digitally literate. Dave explained this contrast between use and digital literacy when he said,

I think in general kids are more adept with the tools, and more comfortable navigating with tools, but they don’t necessarily come in with as much skill as they would to know how to tell a story, or to design something to solve a problem, or for an end user. (D. Livingston, personal communication, December 13, 2016)

Teaching the students at DMA how to use specific applications is not as important as it used to be, even with robotics courses. What is most important is being able to understand and create content that has an end user in mind and this is what DMA aims to teach its students.

***Understand.*** The understand and create categories of digital literacy seem to be quite intertwined at DMA, and the students are taught to understand technology by creating content with it. Paul Lopez explains how students in the game design courses view games through an intricate and critical lens and do not sign up for these courses so that they can play video games, but are interested in how games are developed. Paul explained this concept:

They’re not just looking at video games as entertainment; they’re wanting to learn how it comes together. How the game integrates with game levels and 3D animated characters, textures, and rigging animatronic figures into a virtual world. I think it takes a lot of mindset and critical skills behind the scenes; they’re not just learning to

consume a product but how to understand and create it. (P. Lopez, personal communication, December 16, 2016)

The campers at the Digital Media Academy require a foundation in basic digital literacy skills before they can begin to understand the intricacies of game development, robotics, or even computer programming and design. Trevin York explained these requirements:

If you're going to be using technology to create anything, I do find it's beneficial for them to have an understanding of what they're using and how the technology itself works. That way the constraints of the medium they're using will seem less arbitrary and a lot more of an extension on how everything is put together. (T. York, personal communication, February 1, 2017)

In order to successfully create content, the students at DMA need to understand the capabilities of the technology that they are using so that they can optimize and build within the confines of the medium they are given.

**Create.** Peggy Lee discusses Digital Literacy as a process of creation, where campers are given new technologies to solve problems and work with a set of challenges to create something. Peggy explained,

Being able to see the computer as a tool or a mode of expression is of benefit to young people and will ultimately transform the way they view technology and enhance our relationship between digital and human literacy. (P. Lee, personal communication, December 14, 2016)

Shane White also views digital literacy at DMA as a creation based exercise that involved a great deal of problem solving. Shane identified digital literacy as one of the most important benefits of the Academy. Shane explained digital literacy as:

Being more comfortable with solving problems using technology. Whether that's through computer science or through creating films or designing games and levels. I think the biggest thing is that students get a chance to create something and then share it, get feedback on it, without the pressure of it being graded or judged. (S. White, personal communication, December 14, 2016)

Evan Ryker shared these views and explained the importance of content creation as a process that works towards digital literacy. Evan views completing or creating a product as a representation of a variety of skills and competencies. He believes that creating something with new technologies encompasses:

A goal or series of goals that our students can work towards. And then at the end they have something finished and they can come back and say, this is the one thing I created over the week, as opposed to saying look at these skills I developed. (E. Ryker, personal communication, January 3, 2017)

Sara Gomez's previous experiences lead her to believe that students in the film and visual arts programs would possess the most creative talent, because of the nature of the courses. What most surprised her at DMA was the level of creativity that stemmed from the programming courses. Programming can easily be viewed as a very regimented and finite style of learning, because of the text-based language and syntax rules. Sara explained her discovery and explained her change in viewpoint:

I think the reason the kids in programming really disproved me in that way is because it's a totally from-scratch creation based project, and they're not starting with anything, they're not collecting anything, they're building from nothing. (S. Gomez, personal communication, December 21, 2016)

Trevin York discusses the planning and development phases of curriculum writing. Trevin often puts himself in the shoes of the students so that he can keep them engaged in the learning process. Trevin explains that he expects students for whom he writes curriculum to have little to no understanding of the content. The students that come into each class have a wide range of abilities, which require Trevin to design curriculum that is very open ended,

differentiated, and contains a wide variety of entry and exit points so that each student can confidently start and finish a project. Trevin explained his process of curriculum development:

When the week is thought about through that lens and you're building towards an experience, you realize that they have to be active participants in their own learning at any given moment, and one of the best ways to do that is to get them to build and create things and immediately apply concepts as they're absorbing them. (T. York, personal communication, February 1, 2017)

#### **Theme 4: Debating the Need for the Newest Technologies**

The Digital Divide is a concept of which all DMA curriculum staff are very much aware of. In fact, all participants expressed awareness of how privileged most of the students are and they realize that they are afforded privileges that many young people in the North America are not given. Sara Gomez has experience working in underprivileged education environments and her experiences with DMA are quite different from her past experiences. Sara shed light on these experiences and explained,

In my teaching past some of the things I constantly dealt with are kids that do not have experience with technology, specifically kids from certain populations. I am surprised with the population of kids at DMA and they are super advantaged kids whose parents have a lot of money and they go to really great schools that already have some of the newest technologies and curriculum. I'm really interested to see how DMA's curriculum would fit into a lower served population. (S. Gomez, personal communication, December 21, 2016)

Peggy Lee also feels very strongly about the digital divide and explains that "there are a lot of people not exposed to new technologies, and it becomes an abstract concept for them. I think that leaves people out of a global conversation" and ultimately lessens their future employment opportunities (P. Lee, personal communication, December 14, 2016).

All eight curriculum team members from DMA were asked whether or not they thought digital literacy teaching and learning required technology that is less than two years old. The

responses were diverse and many of the participants provided concrete and compelling examples to support their views. Three primary responses emerged: one developer agreed that technology needs to be less than two years old, five said that it did not, and two expressed mixed opinions. The developers' viewpoints are separated and expressed below.

***New technology is essential.*** Sara Gomez' experiences taught her that children that have been given the latest and greatest technologies in educational environments had a greater opportunity to succeed later in life. She supported this view when she said,

I definitely don't think it's bad pedagogy to work with outdated materials, because I think there can still be pipelines and avenues that can give kids some type of understanding; but I still think the best thing you can do is work with the most up to date materials, because it gives them an edge. (S. Gomez, personal communication, December 21, 2016)

***New technology is not essential.*** The number of developers that believed technology did not need to be less than two years old was surprising, given the nature of the constantly changing technological landscape. From a marketing standpoint, DMA often showcases its newest technologies to impress and entice new students, but it is clear from this study that the foundation of the program and its curriculum has roots that outweigh the newest and most innovative technologies.

Marcus Duvoisin shed light on the balance between new technologies and deeper learning when he discussed his area of expertise, 3D printing. Marcus explained:

In certain cases, how could you teach 3D printing without a 3D printer? But you have to ask yourself, what are we actually teaching? We're teaching them about production. (M. Duvoisin, personal communication, December 14, 2016)

Marcus makes a compelling argument, and ultimately views the 3D printer as a vehicle to reach deeper and richer learning outcomes. This is not to say that a 3D printer is not a beneficial

learning tool, but that students and instructors can achieve similar outcomes using a less technical tool, perhaps like modelling clay. Marcus also admits that family wealth and the type of public or private school a student attends plays a big role in how they perform at the academy.

Peggy Lee explained that new technologies provide a jolt of excitement that could result in engagement, but that it isn't the most important, especially with younger students. Peggy is also a proponent of inexpensive STEM technologies and believes that there is an opportunity to shrink the digital divide. Peggy provided the following example:

Raspberry Pi is a cheap coding tool. You don't really need much to start, and that's the equaling part of technology. As people worry about the investment... the investment doesn't have to be as big of a leap as people might think to get them going. (P. Lee, personal communication, December 14, 2016)

Trevin York is also specifically concerned with the leap from expensive to affordable technologies. Trevin believes that the best technology that can be used by DMA are the ones that they can access once they're done at the Academy. Trevin believes that if there is a situation "where the tools are only professionally available, or those tools cost a lot of money, then it's more important to use older free tools" (T. York, personal communication, February 1, 2017).

Dave provided a unique perspective that focused primarily on the idea that technology is just a tool to create and produce something with a purpose, or a way to help others. Dave said:

I don't think the latest and greatest is that important, it's just teaching students what role technology can play in their learning, and also what they can produce and create with technology. (D. Livingston, personal communication, December 13, 2016)

Evan Ryker also believed that technology should be viewed as a tool for learning and that in order for students to learn, they need a stable platform to do that. Evan believed that newer technologies are not always tested in the way that older ones are. He explained his thinking when he said, “Good technologies are those that have had time to be refined, so if it’s an older piece of technology that has been refined, it can be considered a good piece of technology” (E. Ryker, personal communication, January 3, 2017).

***New technology is seldom essential.*** Paul Lopez and Shane White believe that new technologies and old technologies served a purpose in teaching young people how to create and produce content. Paul believed that computer hardware needed to evolve every year or two because of software upgrades that become faster and more graphic intensive. Paul admits that not all hardware needs to be updated, especially in the engineering discipline, and he explained this when he said:

Robotics kits could be used for many years, and the concepts still apply from 8 years ago. Like gears or operations, performance, actions, commands. It’s the same as it was 10 years ago. Engineering has been around for thousands of years, and the principles still apply to things like bridge building. (P. Lopez, personal communication, December 16, 2016)

Paul is also aware of the constraints that come from publicly funded education policies and believes that additional support in the public school system could be a great way to reduce the digital divide. Paul is also no stranger to the confines of public education and explained that, “Education is such a slow moving ship that once you implement something into a school district, it may stay there for 10 years and not change” (P. Lopez, personal communication, December 16, 2016). The problem with a ten-year plan to implement technology is that most hardware and all software would become outdated.

Outdated software is a challenge at DMA and the curriculum developers are frequently re-writing and re-creating courses based on the software updates that typically come out annually for each of the courses. For this reason, Shane said:

I think what's most important is that whatever you're using you can get support for it. I tell teachers that the best tools are the ones that are free. Not all the time, but most of the time. Because they're free, so many people are using them and if you have a question it's probably already been asked and answered. That's why I'm always telling people to use Unity, because it's free and it's a professional tool. Whereas if you're using an expensive powerful tool, you're going to have to call some support line, and nobody wants to do that. (S. White, personal communication, December 14, 2016)

This theory also applies to older, relatively inexpensive games like Minecraft, which DMA has been teaching for 6 years. The game is so inexpensive that there's a large support community, and that's something that teachers and students need for relatively painless troubleshooting. As Trevin York said, "Nothing takes away a classroom teacher's authority more than them staring and saying, I don't know, I have to figure this out, everyone just wait" (T. York, personal communication, February 1, 2017).

Ultimately, no matter the perspective, all of the developers believed that a student must have a computer with internet access, no matter how old. Shane explained, "I think you can always find a way to give students good opportunities to create and learn these skills as long as you have a computer" (S. White, personal communication, December 14, 2016). Marcus Duvoisin mirrored this way of thinking when he said, "I would say that a computer with internet access could achieve just about anything you want to do. But without a computer with Internet, that's a pretty big hurdle to jump over" (M. Duvoisin, personal communication, December 14, 2016).

## Theme 5: Human-centered Design Approach

One of the themes that emerged from the eight interviews were the concepts of design thinking, user empathy, and projects with a purpose. DMA aims to connect their project-based learning platform with a type of empathetic user engagement and this is something the curriculum staff is working hard working hard to incorporate into all of their classes. It is unclear what theory or term could effectively group the principles of design thinking, design empathy, and projects with a purpose into one category, but one thing is certain, the projects the DMA are aiming to create with their students engages a deeper form of human connectivity.

Peggy Lee explains design thinking as a “human centered design approach where you start and end with empathy” (P. Lee, personal communication, December 14, 2016). Peggy explains that it’s important for a game developer, computer programmer, or artist to think deeply about the consumer and whether or not it will have a positive impact on their lives.

Peggy further explained that instructors and curriculum designers should:

Try to think of all of the problems that you are seeing, that you can actually play a part in, and have the students explore from a place of empathy. And then try to prototype a solution and find experts or organizations to give them feedback on their prototypes, and build from there, making it a virtuous cycle that makes some sort of impact. (P. Lee, personal communication, December 14, 2016)

Dave Livingston is also passionate about design empathy and believes that this way of thinking is more important to him and the Digital Media Academy than just teaching technical skills. Dave explains that “we are also trying to develop a sense of user empathy or design thinking with our curriculum” and he goes on to explain that he wants the students at DMA to ask themselves, “Who’s on the other end of it? Who’s going to be using it? What’s the problem you’re solving?” and this applies when they are creating a movie, robot, or game (D. Livingston,

personal communication, December 13, 2016). Dave advocated strongly for the human-centered approach during the interview, and concluded by saying:

This concept of creating and building with technology is focused on the user, helping people, and problem solving. I think what we need to do is teach them a way, method, or model to use technology to create better products that improve people's lives. (D. Livingston, personal communication, December 13, 2016)

The processes of design thinking, user empathy, and projects with a purpose were difficult to distinguish from one another based on the interview responses. It seems as though design thinking and user empathy are strategies used to make content that is purposeful and makes a positive impact on society. Marcus Duvoisin provided an example that exemplifies the strategies discussed by Dave and Peggy, and it is worth quoting at length:

If I'm sending my kid to DMA, what I would want them to take away is projects with a purpose. So basically not just them going in to make something for themselves, but making something that could make an impact on someone else. As an example, we partnered with an organization called Playground Ideas and what they do is they go out to underdeveloped parts of the world and build playgrounds out of recycled materials. And they don't have the budget to buy designs for playgrounds, so what we did in our 3D printing and modelling class was design a variety of playgrounds and sent all of those designs to the organization and the students had an opportunity to have their designs made in real life. Not only were we developing a non-profit, it also motivated the kids to see how their work is applied outside of the class. It made them realize that what they're doing is bigger than what they're learning inside the class. (M. Duvoisin, personal communication, December 14, 2016)

The concepts of design thinking and user empathy don't always have to be as worldly or impactful as Marcus' Playground Ideas example, and as Shane White explains, user empathy and design thinking can be learned through what he and Trevin call *play testing*. Shane explained *play testing* when he said:

One of the things I think that's lacking in a lot of digital media today is user empathy. Which is trying to put themselves in the shoes of those who are looking at or using their

project. In game design courses every single course has an element of play testing where students play each other's games, and they see how other people react to their games, and this presents them with things they never would have thought of. (S. White, personal communication, December 14, 2016)

Trevin York works as a full-time lead game developer in Oakland California for a company called MindBlown labs. MindBlown labs specializes in game-based behavior modification and education. A project Trevin worked on for years was developing an app called ThriveN'Shine, which is a financial literacy game available for Android and IOS devices. This game was designed with user empathy and projects with a purpose in mind. The game is aimed not only at teaching students about vocabulary and concepts of financial literacy, but to encourage students to start thinking positively about the financial decisions they make in their own lives. The application is designed to be used in the classroom by teachers and is accompanied with detailed lesson plans and discussion guides. Trevin explained that the application is currently being used by teachers in classrooms across the United States and that MindBlown labs recently collected data through a "randomized control trial study and found that somewhere between 80% - 90% of players had a measurable behavior change where they started saving more or budgeting better" (T. York, personal communication, February 1, 2017). Trevin is a huge proponent of games as tools for learning and believes that digital technologies should be used to positively enhance the lives of others. Trevin went into detail about how and why he designed Thrive N Shine, and explained:

The design around it comes from the concept that games are problem solving activities, all games are, so if you intentionally design a game to exercise a problem-solving process that's analogous to a real-world problem, and problem solving progress, you can give people an environment with which they can practice and experiment around a concept, draw connections, and then transfer those behaviors and that knowledge and

experience into the real world, which seems to have happened. (T. York, personal communication, February 1, 2017)

## **Theme 6: Mindset**

Most of the participants discussed a critical mindset as an integral part of the learning process at DMA. Learning to code or build a robot requires a certain set of skills and competencies, and according to many of the curriculum team, mindset is just as important. The developers explained that it is important to have a critical mindset and strong problem solving skills to be successful in the digital media industry. It was also noted that learning to use a variety of new technologies at DMA can also help students develop those critical skills which are transferable into many other areas of their lives.

Trevin York believes that being outside of one's comfort zone is an incredibly important component of developing a digital media skillset. He explained that "These classes are really good at getting students to confront something that is intimidating or scary to them, and teach them that they can accomplish something in that area" (T. York, personal communication, February 1, 2017). This is an incredibly important learning process, and many of the curriculum staff believed that campers are encouraged to embrace an entirely different mindset than the ones they are taught to use in schools. The mindset taught at DMA embraces failure as a learning process, and Trevin explained:

If a student comes into my class and already knows how to make a game or program, they're going to have a good time and learn things, but they won't grow as much if they took a class they knew nothing about. (T. York, personal communication, February 1, 2017)

This is in part because the courses at DMA, "even the advanced ones, are quite introductory. And they're really supposed to provide a positive experience and demonstrate that you are

capable of making something that you are proud of” (P. Lee, personal communication, December 14, 2016). It was clear after the interview process that the courses at DMA, which teach digital skillsets, are much more about developing growth mindsets and confidence.

Many of the developers make reference to formal contexts and they believed that what is offered at DMA is a much more holistic learning experience. Paul compared his experiences as a teacher and a DMA employee when he said:

In my previous experience, the students made a project and turned it in to their teacher. Now, in our camp, we’re sharing what we’ve created. This builds amazing confidence and courage to look at the next phase of their education. Arduino is a very good example, because troubleshooting is learning, you don’t learn unless you fail, and failure is a part of that. There is no learning unless you fail. (P. Lopez, personal communication, December 16, 2016)

Dave Livingston expressed a belief that failure is a part of learning as well. He talked frequently about the lack of engagement that he sees in formal schools, and how he thinks DMA offers a much more engaging, production-based learning environment. The most important part of the production-based environment is that they are taught “to try things without being afraid of failing or breaking, and learn to jump right in” without reservation, or fear of failure (D. Livingston, personal communication, December 13, 2016). Peggy Lee believed that resilience and grit are also an integral part of viewing failure as learning and Peggy believed that “our classes are calibrated so you get a lot of those early wins and a sense of relatability so that they’re protected from the despondency and discouragement when things get really hard” and that the end goal is teaching students to be “resilient, confident, and tech savvy” (P. Lee, personal communication, December 14, 2016).

The courses at DMA teach its students to view all problems as diverse and unique. This is especially clear in the Arduino programs, where two similar problems may require very different solutions. These type of problem solving strategies require a very unique approach that cannot always be taught from a textbook. There is no standardized approach to solving problems, especially in the engineering programs. Evan Ryker found that the most successful students are the ones that look at problems and think, “This is how it’s supposed to be done, but this is how I’m going to do it instead”, and to Evan, “this critical thinking skill is the most important for being successful in this field and environment” (E. Ryker, personal communication, January 3, 2017).

Evan later described the difference between the students that possess the necessary critical thinking skills to be successful and innovative content creators at DMA, and the ones that still struggle to solve problems using a textbook approach. Evan explained:

It seems more like some students acknowledge that there’s one way they’ve been taught to solve a problem, and they set that aside and break the rules to try something different because in their minds it should work better. Whereas other students seem to have a textbook mentality or approach and they continue to try the way they’ve been taught, and maybe even repeat or reiterate those steps even if it isn’t working for them. (E. Ryker, personal communication, January 3, 2017)

There’s also something to be said about the environment and atmosphere at DMA that gives students the mindset, motivation, or confidence to excel in their programs. In many cases, the students at DMA struggle socially in formal learning contexts and DMA provides them with an environment filled with like-minded students. Marcus explained the environment when he compared formal school to DMA and said:

They come to DMA and they’re around all of these like-minded kids and they blossom in this environment. And that’s an internal motivator for me. They get a chance to make

friends and explore their interests. They go to a place where they didn't think existed. (M. Duvoisin, personal communication, December 14, 2016)

Shane White also talked about the environment at DMA in relation to the formal classroom but his perspective was closely tied to DMA's in-class learning environment, as opposed to the broader social environment that Marcus mentioned. Shane explained:

When students come to the digital media academy it is a different environment. They're usually given a step by step worksheet and they're not necessarily interested in solving their own problems, instead they're just looking for answers, where at DMA we don't define what they're going to make. So the idea of finding the path from nothing to fulfilling your idea is a really big skill. I think it's nice because they're more motivated to solve those problems based on their own ambitions and creativity. This happens to me all the time when I'm trying to make something and I don't know how to do it... I'll figure it out because I want it to happen instead of needing it to happen and I think that's a much more rewarding process. (S. White, personal communication, December 14, 2016)

## Chapter 5: A Critical Analysis

The current chapter bridges the gap between the themes uncovered in the eight interviews and the practices and curriculum in the Ontario education system. This chapter draws on pedagogy and competencies, both of which are presented through the eyes of an educator. The following represents the six themes participants addressed in their interviews:

1. Digital literacy pedagogy is production-centered
2. Digital literacy pedagogy requires a growth mindset
3. Digital literacy pedagogy does not require expensive technology
4. Coding/programming is a core digital literacy competency
5. Digital storytelling is a core digital literacy competency
6. Human centered design is a core digital literacy competency

### **Digital Literacy Pedagogy is Production-centered**

The digital literacy model found in Figure 1. (Chapter 1, p. 18) represents a nonlinear process of becoming digitally literate. The model is broken down into four key sections, *Access*, *Use*, *Understand*, and *Create*. The DMA focuses its production-oriented instruction on the *understand* and *create* portions of the model. Teaching students to use the equipment at DMA was only mentioned once during the interviews because the majority, if not all, of the students at the DMA have had experience with computers in the past. This is not to say that all students are proficient in using complex programs like Maya, Unity, Logic Pro, or Java, without the assistance of the instructor or teaching assistant; but to say that achieving this level of understanding can be done through hands-on creation, rather than step-by-step instructions.

Trevin York designs curriculum at DMA so that it is as engaging as it can be for his students and he realized that students “have to be active participants in their own learning at any given moment, and one of the best ways to do that is to get them to build and create things, and immediately apply concepts as they’re absorbing them” (T. York, personal communication, February 1, 2017). Trevin’s pedagogical beliefs about active participation in learning tells us he believes that the step-by-step instructions, worksheets, or Smart Board notes are not as effective or engaging as production-based lessons that give students context and agency in their learning.

Based on a survey of 4,043 K-12 teachers, many considered 5 digital literacy skills to be the most important (Johnson et al., 2016). None of these skills are creation or project-based strategies popular with non-formal learning environments like the DMA. These five skills were collected through a survey performed by the Canadian Teachers Federation and Media Smarts (Johnson et al., 2016). The following 4,043 K-12 teachers identified:

1. Staying safe online,
2. Appropriate online behavior,
3. Dealing with cyberbullying,
4. Understanding online privacy issues and settings, and
5. Verifying that online information is credible/relevant/accurate.

The five skillsets identified in the survey are closely related to digital citizenship, but also fall into the categories of *use*, and *understand* from the digital literacy model in Figure 1. If teachers in Ontario continue to focus the majority of their efforts on teaching students to be safe online without showing them how to be responsible and active online creators, there will be a gap in

Ontario students' digital literacy based on the more complex levels of the digital media model utilized for this thesis. Digital Citizenship is a term that is evolving and dynamic, and it is known to encompass anything from learning to connect to Wifi, to recognizing and preventing cyber bullying. The Waterloo District School board (WDSB) created a Digital Citizenship policy called the Responsible Use Procedure (RUP). WDSB identified the following measures to ensure digital citizenship is met by its staff and students:

1. Respect yourself
2. Protect yourself
3. Respect others
4. Protect others
5. Respect intellectual and technology property
6. Protect intellectual and technology properly

(Waterloo District School Board, 2016)

These principles are notably ambiguous and generic, but reflect only one school board's attempts at generating a comprehensive digital citizenship framework. School boards appear to be treating new technologies like scary new developments that require reactive approaches, rather than proactive learning opportunities. Digital citizenship is a reactive approach to preventing and mitigating poor online behavior and this is certainly a high priority, especially with regards to the new wave of online bullying. Ontario students however, require much more than citizenship when it comes to developing 21<sup>st</sup> century skills and competencies. Students require skills for employment and high level access to 21<sup>st</sup> century learning opportunities that extend beyond the walls of the classroom and in to the real world. Students in the K-12

education system should be learning to use new technologies as a creation based learning platform for the purposes of cultural empowerment and social awareness. The idea that our students should learn how not to use something fails to teach them how it should be used.

The WDSB document continued on to list other parameters that included; identifying viruses and malware, learning to connect to Wi-Fi, and disabling internet sharing (Waterloo District School Board, 2016). Most interestingly, the document made the connection that students must operate in a manner “consistent with Character Development and Digital Citizenship goals” (Waterloo District School Board, 2016). Other school boards also created their own parameters, including the Durham District school board with their “Digital Citizenship Boot Camp”, Grand Erie District School Board developed a “Code of Digital Citizenship”, Hamilton Wentworth District School Board and the Ottawa Catholic School Board also developed their own working definition of Digital Citizenship (EduGains, 2016).

Schools in Ontario would benefit from a well-rounded hybrid approach and this does not mean that the teaching and learning at the DMA is the perfect way to do it, but to say that students should be learning to be responsible digital citizens, while learning to create engaging and culturally empowering content online. Digital Citizenship was mentioned once during the eight interviews with DMA curriculum staff, and it is clear that they are not focused on teaching students to be responsible online citizens in the way that Ontario schools are. During Peggy’s interview she mentioned educational practices in the California area:

The schools and teachers here have made a big commitment to digital citizenship, and that’s a piece that we don’t really cover at DMA. There’s a lot of liability there and I’ve seen how it can be detrimental but I think that at DMA we could do a two-prong approach where we could be safe and be good, but also creative and exuberant. (P. Lee, personal communication, December 14, 2016)

The idea that digital citizenship is synonymous with being safe and good is somewhat narrow sighted and that is something that both the DMA and some school boards in Ontario have in common. The creativity and problem solving skills that DMA works so hard to develop are synonymous with digital use and integration, while the school boards seem to view digital media and new technologies as a liability, and rightfully so, with the new wave of cyber bullying, sexting, and privacy issues.

A more progressive model of Digital Citizenship was developed by Zehra Altinay Gazi (2016). For Gazi, digital citizenship encompasses 9 common themes and they are represented in the following table:

*Table 2. Digital Citizenship Themes*

<b>Common Themes</b>	
Digital Literacy	Being digital literate Conducting research in digital context Having ability with self-confidence
Digital Law	Rules and restrictions
Rights and Responsibilities	Personal rights Personal responsibilities
Digital Communication	Social relations and interaction Knowledge and information sharing
Digital Security	Feeling confidence Securing username and password
Digital Commerce	Involving digital trade and online shopping
Digital Access	Access to the digital resources Solving problems in digital access
Digital Ethics	Respecting to privacy
Digital Health	Addiction Effects on psychology

(Gazi, 2016, p. 145)

Gazi's table includes digital literacy as the first common theme when considering digital citizenship and this lends itself nicely to this thesis. In order to achieve the full range of digital skills and competencies, K-12 students in Ontario need to be taught how to be digital citizens by learning to create, produce, and engage with online learning communities. Gazi's themes encompass the DMA focus as well as the focus by many school boards in Ontario. Gazi's table represents the hybrid approach that Peggy wishes to see at the DMA.

### **Digital Literacy Pedagogy Requires a Growth Mindset**

Part of developing a well-rounded digital literacy program involves teaching students how to manage problems, progress, and failure. It is more important now than ever that Ontario students learn to think critically and approach all situations as learning opportunities to better themselves in the future. It is clear that non-academic learning like "intrapersonal competencies such as grit, tenacity, and a growth mindset have a strong relationship with an individual's capacity to overcome challenges and achieve long-term success" (EduGains, 2016, n.p.). The focus at the DMA extends upon academic achievement, and focuses greatly on teaching 21<sup>st</sup> century competencies and skills that extend beyond the Academy's learning environment.

Peggy mentioned grit, resilience, and a growth mindset as integral parts of the learning process. Paul Lopez even went as far as to say that in the digital media disciplines, "there is no learning unless you fail" (P. Lopez, personal communication, December 16, 2016). Carol Dweck, the author of *Mind-set* (2006), believes that there are two distinct mindsets, a *fixed* and a *growth mindset*. A person with a fixed mindset believes that intelligence is innate and they have

a set of talents and a set of shortcomings, both of which cannot be changed (Dweck, 2006).

While the concept of a growth mindset provides an ideal perspective for overcoming challenges and embracing a more flexible approach to classroom learning that is not based primarily on identifying and rooting out errors, it falls short of its potential under closer scrutiny. Dweck presents two rigid and opposing ideas, both of which rely heavily on constructive feedback, especially in the formative years. The adoption of a growth mindset for an elementary student is only as progressive and impactful as the feedback he or she is given. How can a student adopt a growth mindset and interpret failure as a learning opportunity, if he or she is unsure of their errors? Adopting a growth mindset is crucial to encourage a shift towards the classroom as a constructivist learning community, but it is equally as important that educators and mentors provide formative and summative feedback and model a growth mindset themselves.

The following visual was created by Reid Wilson in an attempt to teach elementary students the difference between a growth and fixed mindset,

## What Kind of Mindset Do You Have?



Created by: Reid Wilson @wayfaringpath © ① ② ③ Icon from: thenounproject.com

Figure 6. Growth Mindset Diagram (Wilson, 2014)

A fixed mindset, when applied to disciplines like computer programming and robotics, would ultimately result in immense frustration and a defeatist mentality. In order to be successful in most digital media disciplines, a student must have a growth mindset. Programs at the DMA are incredibly challenging and all students are met with a host of different problem solving activities. In many cases, students are taught how to solve their own problems, rather than being provided with answers. Many instructors that work with DMA spend a portion of their earlier lessons teaching students how to independently troubleshoot and solve broken code or a malfunctioning robot. Teaching students at DMA to solve their own problems gives

them a sense of agency, teaches them critical thinking, and helps them to embrace the mindset that they can, independently, solve any problem they are confronted with in their daily lives.

The process and way in which students at DMA learn about feedback is also a large component of their development of a growth mindset. Students with a fixed mindset believe that when they do not perfect something, they are not good at performing that task. At the DMA, students are encouraged to provide constructive feedback to every one of their classmates. In game development, students are taught a growth mindset through playtesting, where another student must play one of their games and give feedback as an end user. As Shane White explained, the best thing about the DMA is that the “students get to create something, share it, get feedback on it, without the pressure of it being graded or judged” (S. White, personal communication, December 14, 2016). The pressure of an assigned grade is taken away from the projects the students are creating and this ultimately shifts their focus so that they can work towards making their projects better for their own satisfaction, or the satisfaction of their end user.

The production focused learning environment at the DMA is also closely linked to teaching students to have a growth mindset. Dave Livingston said that students must learn to “try things without being afraid of failing or breaking, and learn to jump right in without reservation, or fear of failure” (D. Livingston, personal communication, December 13, 2016). Teaching students to view projects as intrinsically motivating tasks helps them to develop a growth mindset, and helps them to view challenges as learning opportunities, rather than opportunities for failure or success.

It is also important to note that the courses at the DMA may appear, to an industry outsider, incredibly intricate and difficult to master. To an extent this is true, but for someone in the industry, these courses only scratch the surface of the learning that needs to be done. For this reason, it is incredibly important that students have a good and positive experience in the courses because they need to have confidence if they wish to pursue this later in life. Peggy explained this when she said, “Our classes are calibrated so you get a lot of those early wins and a sense of relatability so that they’re protected from the despondency and discouragement when things get really hard” and that the end goal is teaching students to be “resilient, confident and tech savvy” (P. Lee, personal communication, December 14, 2016).

The idea that failure is tightly linked to learning is foundational at the DMA, and this is taught through the production oriented learning style, the feedback students are given, and the lack of grading and evaluation from teachers. Not only do digital media industry professionals need a growth mindset to be successful, but being introduced to digital media at a young age, with the help of a professional, can actually help to develop a growth mindset. The number of challenges that students overcome throughout the week are countless and the finished product that they take home with them is a testament to their grit, resilience, and growth mindset.

### **Digital Literacy Pedagogy Does Not Require Expensive Technology**

Marcus, Peggy, Trevin, Dave, and Evan state that new technology is not essential to teach a variety of digital media disciplines; but Paul and Shane believed that it is not the most important factor, but that in some situations it would be beneficial. In many cases, the developers felt that an older computer with internet access could present a great deal of learning opportunity. There was also an emphasis that inexpensive or free software would

provide the most seamless learning opportunity. This is certainly beneficial for schools and teachers with limited budgets for new technology or software. Free technology is also very popular, which results in larger online communities and support systems. As Shane said, “If you’re using an expensive powerful tool, you’re going to have to call some support line, and nobody wants to do that” (S. White, personal communication, December 14, 2016). The interviews with DMA curriculum staff identified three main criteria for implementing or adopting new technology into an education setting:

1. The technology should be inexpensive or free;
2. The technology must have a supportive and accessible online community; and
3. The technology must be compatible with the technology students have at home.

The following section will demonstrate two examples of digital literacy technologies that meet the outlined criteria in detail. These examples could represent a formal education learning environment that can overcome the barriers of cost, support, and teacher training. These factors should not be deterrents in developing meaningful and essential digital literacy pedagogy.

**3D printing.** Tinkercad is a 3D design application that can be introduced to children as young as six years old. The software is web based, meaning that software installation is not required, and students can create their own online accounts with as little as a teachers email address. The Tinkercad website, [www.tinkercad.com](http://www.tinkercad.com), makes use of a drag and drop style platform that students and teachers could easily navigate, even those new to 3D design. In the event of a technical issue that renders the user unable to solve a problem, there is a free and open blog on the website that allows consumers to engage in an online learning community.

The language used in the web-based design platform is student-friendly and makes use of student-friendly language. There is also a section designed specifically for educators and it is free to sign up and register. Arguably the most beneficial element of this 3D print application is that students can resume working on their creations from home by logging in with their personal account. As Trevin said, the most important part of bringing new technologies into the classroom is making sure those technologies are accessible to students outside of school. For this reason, web-based learning platforms provide the best and most diverse learning potential because teachers and students will not need to worry about Apple or Windows operating systems, hard drive space, or software updates.

Tinkercad can be taught as early as grade 2, and requires nothing more than an inexpensive Chromebook. As Marcus mentioned during his interview, teachers do not necessarily need a 3D printer to teach 3D printing, mainly because the course aims to teach principles of design, rather than the technical makeup of a 3D printer. Teaching 3D printing in the classroom would not be as beneficial without being able to print the creations that students have made throughout a unit. The 3D printers found at the DMA can cost up to \$1500 USD and this is not a realistic expense for Ontario classrooms. To avoid this costly investment, Marcus suggested using 3D print companies like Shapeways. Shapeways is a US based 3D print shop that prints and delivers 3D models to the buyer; the Canadian counterpart would be 3D Hubs, and they offer a 25% discount for students and educators. Students could create a free 3D model and integrate this into a science, social studies, language, or math unit and have it printed as a culminating task for a small fee.

**Virtual reality.** Virtual reality (VR) is an emerging technology that is reshaping a variety of industries including real-estate, industrial development, education, and health care. Exposing students at to VR at a young age would be of great benefit to their future selves, but VR is thought by many to be an expensive learning platform only for those with expert knowledge. To an extent this belief is true with advanced VR technologies like the Oculus Rift and HTC Vive, which cost upwards of \$600 USD. The VR market is becoming less of a niche market and companies like Google are developing inexpensive technologies for the average consumer; in most cases, a cell phone within the last two or three years could act as a VR generator. In relation to the 3D printing technologies, VR is less about learning to use an Oculus Rift or HTC Vive and more about learning to create alternate and virtual realities for learning. Many 21<sup>st</sup> Century learners are naturally engaged in virtual realities and it is important for teachers to tap into this learning potential.

CoSpaces is a web-based virtual reality site designed for classrooms. CoSpaces is a free site that offers learning opportunities for beginning and intermediate creators. Creating intricate design worlds are available through computer languages like JavaScript and Blockly, but also through a drag and drop learning platform that can be used by anyone with basic navigation skills. CoSpaces requires as little as an email address to create a cloud-based account that lets users save content and access it from any browser on any computer. CoSpaces also has a very active online community of educators that share lesson ideas, personal creations, and trouble shooting questions; these can be found through CoSpaces Classroom in a public group on Facebook. CoSpaces is designed so that it can be integrated into a variety of subjects through storytelling, modelling, literature interpretations, and infographics. Students would be

able to immerse themselves in these virtual worlds with a cell phone and one GoogleCardboard, which would cost no more than \$5 CAD.

**Hardware funding.** 3D printing and virtual reality were selected to demonstrate that even the most expensive digital media disciplines can be integrated into the classroom at little to no expense, beyond what is already available in most Ontario schools. In both cases, a Chromebook is all that would be needed to integrate these subjects into the classroom. The engineering disciplines, as well as film and music, can be approached with medium to low-level technologies that can bring valuable learning opportunities into the classroom. Paul Lopez is an advocate for integrating new technologies into the classroom, and as a former teacher, he understands the financial limitations placed on a classroom. Paul is a testament to the type of teacher that exemplifies the 'can do' attitude of a resourceful and persistent educator. Paul talked at length about his use of the organization, Donors Choose. Donors Choose is an organization that puts educators in touch with private corporations or individuals that are looking to donate money or materials not funded by the State. Paul provided his entire school in Austin, Texas, with Chromebooks at a 1 to 1 ratio after he posted an application on Donors Choose. Paul also mentioned that companies like Google and AT&T will flash fund classrooms on Donors choose and supply hundreds of classrooms with the funds they need to improve their technology infrastructure. Paul recognizes that education initiatives are often carried out from the bottom up, and not from the top down. In Canada, teachers seeking corporate donation can make use of MyClassNeeds, which can be found at [www.myclassneeds.ca](http://www.myclassneeds.ca).

## **Coding/Programming is a Core Digital Literacy Competency**

Six of the curriculum developers at DMA identified computer programming as the most valuable and foundational digital media skillset today. Luckily for students in Ontario, coding is gaining traction. Education Minister Mitzie Hunter said, “We need to equip our students with the skills to thrive in a world where technology is constantly evolving”, and that is why the government will invest \$150 million into a special technology fund over the next three years (Rushowy, 2016). Although this promise of funding is a start, it doesn’t seem as though this will be enough, with only a third of high schools in Ontario offering computer coding courses, and when they are offered, they are electives in grades 11 and 12 (Roumeliotis, 2015). To provide contrast, the U.K. model teaches programming just like Math and Language and from an early age (Roumeliotis, 2015). Paul Lopez also believes that coding should be taught to students at a young age and should be mandatory, mainly because globally we are moving towards a programming-based economy. There is certainly merit in Paul’s statement, with new robotics technologies overhauling the manufacturing, healthcare, and automotive industries, as well as delivery retailers like Amazon. Ontario’s blue-collar job market will look much different 20, or even 10, years from now and living in a programming-based economy without at least a basic knowledge of computer science would put Ontario students at a disadvantage and leave Ontario out of a global technology race.

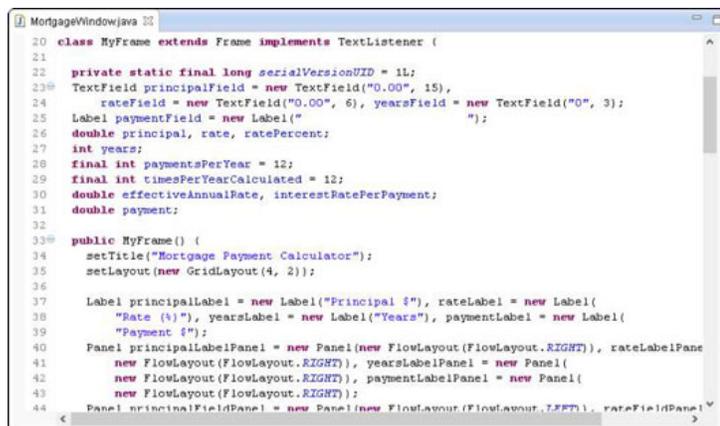
For now, students currently in Ontario schools are being exposed, at least inconsistently, to novice coding technologies like the Sphero, Dash & Dot, Lego EV3, and a host of apps like The Foos, ScratchJR, and Tynker. These coding applications are a great start in the primary divisions, but not necessarily in the junior, intermediate, or senior divisions. To provide a point of

reference, the previously mentioned coding technologies, when compared to traditional literacy, would teach children the equivalent of the return sweep, or to read and write from left to right. As Shane White said, there are many great coding applications and products for children at the beginning stages, but the gap between those technologies and actual computer coding languages like Java, is far too great.

At the moment, it is not clear whether there is a perfect intermediate application that would seamlessly transition students from novice coding languages like Scratch to Java, but at the very least, it is clear that Ontario students should finish grade 12 with a basic foundation in traditional and real world applicable languages like Java, JavaScript, C+, or Python. To provide a point of reference, the following images depict the difference between Scratch, a novice computer language, and Java, an advanced language used in the real world.



*Figure 7. Screen Capture of Scratch Code*



```

20 class MyFrame extends Frame implements TextListener {
21
22     private static final long serialVersionUID = 1L;
23     TextField principalField = new TextField("0.00", 15),
24         rateField = new TextField("0.00", 6), yearsField = new TextField("0", 3);
25     Label paymentField = new Label("");
26     double principal, rate, ratePercent;
27     int years;
28     final int paymentsPerYear = 12;
29     final int timesPerYearCalculated = 12;
30     double effectiveAnnualRate, interestRatePerPayment;
31     double payment;
32
33     public MyFrame() {
34         setTitle("Mortgage Payment Calculator");
35         setLayout(new GridLayout(4, 2));
36
37         Label principallabel = new Label("Principal $"), rateLabel = new Label(
38             "Rate (%)", yearsLabel = new Label("Years"), paymentLabel = new Label(
39             "Payment $");
40         Panel principallabelPanel = new Panel(new FlowLayout(FlowLayout.RIGHT)), rateLabelPanel
41             = new Panel(new FlowLayout(FlowLayout.RIGHT)), yearsLabelPanel = new Panel(
42             new FlowLayout(FlowLayout.RIGHT)), paymentLabelPanel = new Panel(
43             new FlowLayout(FlowLayout.RIGHT));
44         Panel principalFieldPanel = new Panel(new FlowLayout(FlowLayout.RIGHT), rateFieldPanel

```

Figure 8. Screen Capture of Java Code

The gap in complexity and functionality between these two languages is massive. Scratch is a bubbly, student-friendly, command-based application where students can select drop down menus, code based on colour schemes, and use plain English to deliver commands. Java however, is a text-based programming language that relies on highly structured syntax and commands that must be memorized and used correctly in order for the program to function. Sara Gomez believes that computer languages like Java enhance creativity because it truly is a language that can produce unlimited learning opportunity.

Minecraft is used at the DMA in the Junior Adventure and Teen programs to teach a variety of coding and game elements with Java. Minecraft is perhaps one of the most engaging vehicles to teach students how to use Java. Students that learn to play Minecraft on their own do not possess the technical wherewithal to meet Minecraft's learning potential independently because of its vast potential for Java based modifications. Students at DMA can learn to alter, modify, and enhance their Minecraft world with the implementation of Java through the support and guidance of an expert instructor. Minecraft exposes a number of misconceptions

regarding educational trends used by teachers and the public. On the one hand, teachers and parents may view Minecraft as an educational tool and find comfort in knowing that their students or children are learning valuable skills through play, and in some cases this is possible. In order for students to learn coding through play, they must first employ a foundational understanding of Java, which is difficult to achieve independently. For this reason, Minecraft should be introduced in grade two as a learning tool to teach Java, and this could help students skip introductory applications like Scratch and begin to learn real coding languages in game-based environments. Minecraft also offers an excellent opportunity for teachers to extend student learning from the school to the home and this would undoubtedly instill an interest in Java programming at a young age, which could be built upon in later grades to explore real world applications of computer science.

### **Digital Storytelling is a Core Digital Literacy Competency**

Digital expression or storytelling was a recurring theme during the interview process and this provided a unique perspective to the digital media disciplines in the education framework that can be applied to Ontario school contexts. In the previously mentioned sections, digital media was portrayed by myself and the participants as a highly technical and important life skill for Ontario students. It was also portrayed as a subject or discipline that required an overhaul of curriculum to find a place inside the classroom. Interviewees Shane, Paul, Dave, and Peggy described digital media disciplines as a mode of expression that is very much innate to the human condition and could also be integrated seamlessly into traditional subjects without a complete revision of curriculum or pedagogy.

In many cases, technical knowledge is important at the school level, but also in terms of obtaining a job in the future. Paul Lopez and Shane White emphasized the importance of adopting digital media into everyday lives from the perspective of personal expression. As a species, humans have and always will be natural born storytellers and it is important to carry that innate human element into the digital age. Digital media provides a diverse and seamless opportunity for students to continue as story tellers, through a variety of different media including games, videos, websites, blogs, vlogs, app development, films, music, and robotics. As Paul explicitly stated, "I think 21st century education must have that continuum in another format, and that needs to continue through a student telling a story with a visual digital medium, whether that's making a video, a broadcast, or a 3D animation" (P. Lopez, personal communication, December 16, 2016).

The Canadian Teachers' Federation partnered with Media Smarts to determine which technologies and media were being used most frequently in the classroom (Johnson et al., 2016). They surveyed 4,043 K- 12 teachers and school administrators who assessed teachers' relationships with networked technology in their classroom and how technologies impacted their teaching practices. The chart from Figure 2. in the chapter titled, An Overview of Digital Literacy in Education, represents the data reported from this study. The most staggering data recorded from this chart can be seen in the dismal orange section titled, Creating content. It is clear that some teachers in Canada are using a variety of digital technologies for the purposes of accessing information online, but not necessarily for creating content in a meaningful way. The Videos section demonstrates the highest level of accessing content and creating content in this graph and that can be attributed to Youtube, the site most frequented by students in the

elementary school system (Steeves, 2014). Students are consuming and exploring a large quantity of information through video-sharing platforms as consumers but also as new media producers outside of school. Teachers need to continue using online media as an outlet for research, investigation, and inquiry, but most importantly, students should be learning to be active producers. Shane White said that it only takes a few moments on Facebook to learn that young people are struggling to create engaging and meaningful content online and this can only be improved through teaching and learning. Students are creating and navigating online spaces without direction, support, or context. It is the role of the Ontario classroom to demonstrate how students in the K-12 grades can tell stories, create content, and remix new media in a meaningful and purposeful way.

Teachers must begin to incorporate digital media into their rich assessment tool kits. Students should no longer only be asked to write papers, take tests, or create PowerPoint presentations; this is not to say that these forms of assessment do not have a place in the classroom, but to say that assessment should be diversified and differentiated to incorporate 21<sup>st</sup> century tasks. Stop animation, films, virtual worlds, 3D designs, public service announcements, vlogs, and websites could all be included or incorporated into traditional subjects in K-12 classrooms as Rich Assessment Performance Tasks (Drake, Kolohon, & Reid, 2014). Digital media does not have to be viewed as an educational wrecking ball into the traditional, comfortable, and current classroom dynamic, but it can be viewed as a supplement or addition to the typical and in many cases, outdated assessment tasks seen in many Ontario classrooms.

## Human Centered Design is a Core Digital Literacy Competency

The DMA has a strong focus on a human-centered design approach that is fulfilled through teachings of user empathy, design thinking, and projects with a purpose. Peggy described the human-centered design approach as one that “starts and ends with empathy” (P. Lee, personal communication, December 14, 2016). The DMA’s production or creation centered environment teaches students to create for the purposes of enhancing or improving the lives of the end user. New technologies are not always viewed this way in schools and it is important that schools begin to view new media as a mode of production for in-class assessment and as a vehicle to improve the lives of others.

Schools in Ontario have a strong focus on character education, which aims to teach a variety of valuable attributes including integrity, empathy, courage, inclusiveness, cooperation, and many others. In some cases, digital citizenship encompasses some of these character traits, but these traits could be brought into the school from the perspective of using, understanding, and interacting online with others, rather than through the online creation process.

Design thinking and the human-centered design “involves observations and development of a deeper understanding of how people use a product and interact with it, and the role the product plays in their lives” (Coleman, 2016). The design thinking process is more engaging for students because it gives them a sense of agency in the world outside of the classroom. The Playground Ideas example that interviewee Marcus provided is an excellent way of teaching design thinking that connects students to global issues in a meaningful and impactful way. Implementing design thinking into the traditional classroom, in a variety of subjects, would help students develop a stronger connection between technology and

humanity.

The technology used to teach a human-centered design approach does not always have to start and end with high level technologies that one would find at the DMA, but can start with the development of board games, card games, or even outdoor games. The popular card game Pokemon, which has been prominent in schools since the late 1990s, is a perfect example of an engaging game that had the potential to enhance academic learning. Pokemon could have incorporated a global or ecological footprint design that revolved around enhancing our natural environment, and the current game design could have supported that. From an ecological standpoint, many of the characters in Pokemon make use of natural or man-made resources, including but not limited to water or ice, plant life, fire, electricity, steel, and poisonous substances. The Pokemon game could have incorporated a much larger and impactful design methodology that could have benefited society on a much larger scale, similar to Trevin's Thrive N Shine application that enhances students understanding of 401 K's and retirement through game-play. Thrive N Shine is engaging enough that it subtly teaches students about making responsible financial decisions and is not marketed to students as an educational finance game. Marketing the Thrive N Shine as an educational game could have deterred some students from engaging with the game in authentic play and may have deterred them from playing in the first place.

Design thinking not only helps to give students real world context to their learning, but it helps to develop empathy. Students who are creating games, robots, or apps need to think about who is going to be using them in order to develop a connection between technology and empathy. This is incorporated into the DMA model purposefully because it has certain benefits

that extend beyond the DMA or the classroom. This is especially clear when Trevin York talked about play-testing as a major component of game-development. A game developer must continue to have others play his or her game so that he or she can see how others interact with the in-game elements. It can also be said that the “cornerstone of design thinking is empathy; when the designer better understands the day-to-day needs of a group of people, the design of a solution will better fit the needs of those people for whom solution is needed” (Coleman, 2016). To create an effective digital literacy program, teachers need to teach students about the human side of technology through design thinking, user empathy, and an overall human-centered design approach.

## Chapter 6: The Future of Ontario Education

New technologies are drastically and swiftly changing the way we conduct our everyday lives; they have had an impact on how we work, study, play, relax, consume, communicate, and participate in community and nation. However, the impact of these new technologies has been uneven in the various sectors and domains and is still in process. One of the slow adopters is Education, according to Joel Rose (2012), cofounder and chief executive officer (CEO) of New Classrooms Innovation Partners:

The Information Age has facilitated a reinvention of nearly every industry except for education. It is time to unhinge ourselves from many of the assumptions that undergird how we deliver instruction and begin to design new models that are better able to leverage talent, time, and technology to best meet the unique needs of each student. (Rose, 2012)

It is important that educators not only prepare students for a changing world by rethinking and transforming the current ways of teaching and learning, but provide young people with the wherewithal and confidence to critically detach themselves from the world they live, to question its trajectory, assess the future of humanity, and invent a space for themselves to participate as active citizens and workers. It is important that students learn, from an early age, that no problem is too big or too small to critically analyze in the classroom. Developing a well-rounded digital literacy program is multi-faceted; on the one hand, young people must possess the skills and competencies to be successful in 21<sup>st</sup> century work environments, but they should also be taught to have free-standing thought and approach new industries with a degree of skepticism that breeds independent, original, and innovative thought.

Moly Burkley (2014) believes that “the growth of digital media and new technologies is, at its core, a literacy issue” (Buckley, 2014). Burkley’s literacy issue stems from the new

challenges that the Information Age presents young people. A critical, reflective and skeptical approach to new media is essential, but unfortunately overshadowed by society's consumer culture that seeks constant and instant gratification. James Martin (2007) believes society needs to reflect, question, and effectively challenge new technologies and their place in our world. Martin expresses this through his ideas of the *skill and wisdom gap* in our society which represents an imbalanced set of values that prioritize efficiency and profit over everything else (Martin, 2007). Martin explained this skill and wisdom gap when he said, "Today, deep reflection about our future circumstances is eclipsed by the rush to build faster, cheaper, smarter, more-efficient gadgets that will increase corporate profits. The skill-wisdom gap is enlarged because skills offer the ways to get wealthy (Martin, 2007).

The Ontario education system is in dire need of a comprehensive digital literacy program so K-12 students can be successful in a society reliant upon employees with digital media skillsets and competencies. A new digital literacy program is also essential to the Canadian workforce. The Canadian government and a variety of digital media industries "agree that by 2020 the sector will face a shortage of 220,000 workers" and the challenge for the government is that "technology is destroying old jobs almost as fast as it's creating new ones" (Cochrane, 2017). This shift towards what interviewee Paul called a *programming based economy* will result in a situation "where we have people without jobs, and we have jobs without people" (Cochrane, 2017). It is the role of the Ministry of Education to begin working swiftly to prepare young people for life in the 21<sup>st</sup> century and to meet the growing demands of the workforce.

## Available US Models

In the United States, several organizations are working closely with the state school system to develop new skills and competencies for students growing up in the 21<sup>st</sup> century. It is important to briefly examine these established digital literacy frameworks to gain insights and perspectives that can be adapted to fit the Ontario education system.

**The College Board.** The College Board in the US is a not-for-profit organization that helps students transition from secondary school to College by implementing programs like the Scholastic Aptitude Test (SAT) and Advanced Placement programs (AP) in Science Technology Engineering and Math (STEM) disciplines. In the Fall of 2016 the College Board developed an AP course titled, *Computer Science Principles*. This course is available to high school students in the US and if successful in passing the course, the credit will count towards first year College programs. The College Board has generally identified their AP computer science course, “The New Literacy” and claims “whether it’s 3-D animation, engineering, music, app development, medicine, visual design, robotics, or political analysis, computer science is the engine that powers the technology, productivity, and innovation that drives the world” (CollegeBoard, 2016). The *Computer Science Principles* course also places a great deal of emphasis on real-world problem solving and creative thinking, not just technical skill development. The College Board offers a framework that could serve the Ontario school system well and eventually bridge the gap between primary and secondary school with Ontario Colleges and Universities. The College Board believes this relationship to higher level education is essential for preparing young people for life in an ever changing and dynamic world.

***International Society for Technology in Education.*** The College Board is not the only organization in the US dedicated to preparing young people for success in our digital world. Ontario educators can look to the International Society for Technology in Education (ISTE) for cues to developing a comprehensive digital literacy framework. ISTE has developed standards that they believe are imperative to educating young people. The 7 standards developed by ISTE mirror much of what was discovered in this thesis. One of the standards is titled, *Innovative Designer*, and teaches students about a deliberate design process that makes use of the human-centered design approach and project-based learning strategies mentioned by the DMA interviewees (ISTE, 2017). ISTE also offers a standard titled, *Global Collaborator*, and this is something that should be emphasized in all digital literacy frameworks. The *Global Collaborator* is a standard that teaches students to explore issues in their community using technology to find solutions to complex, real-world problems. Finding solutions to complex problems like environmental instability, political unrest, and economic uncertainty are issues neither too big or too small for students to engage with in the classroom.

### **Synthesizing an Ontario Framework**

In the winter of 2016, the Ontario Ministry of Education released a discussion paper titled, *21<sup>st</sup> Century Competencies*. It is important to critically analyze this document in its entirety due to its timely release and relevance to this thesis. This document engages in a meaningful conversation about the future of the Ontario education systems school structure and curriculum. The aim of the Ministry of Education document is to spark a conversation about the ways Ontario educators can “prepare students to solve messy, complex problems –

including problems we don't yet know about – associated with living in a competitive, globally connected, and technologically intensive world” (Ministry of Education p. 3, 2016).

*21<sup>st</sup> Century Competencies* (2016) by the Ministry of Education uncovered, through a literature review of current technology education research, six 21<sup>st</sup> century competencies that they believe are essential for the success of all Ontario students in the digital age:

1. Critical thinking and problem solving;
  2. Innovation, creativity, and entrepreneurship;
  3. Communication;
  4. Collaboration (teamwork);
  5. A growth mindset (metacognition/ learning to learn, perseverance, and resilience);
- and
6. Local, global, and digital citizenship.

Many of these highlighted competencies link directly to the findings in this thesis. The following subsections will dissect core 21<sup>st</sup> century literacies from this Ministry of Education document and make critical comparisons to the themes uncovered through eight interviews with DMA curriculum staff.

***Critical thinking and problem solving.*** The Ministry of Education quotes Fullan (2013) and uses his definition to define critical thinking in the 21<sup>st</sup> century; the quote reads, “Critical thinking in the 21<sup>st</sup> century is described as the ‘ability to design and manage projects, solve problems, and make effective decisions using a variety of tools and resources’” (Ministry of Education, 2016, p. 12). The shift in modern technologies and its effects on the workforce suggest that the tools and resources used for problem solving and critical thinking will be new

technologies like, virtual reality equipment, 3D printers, computer coding, and robotics equipment. The technology resource shortage in schools presents a unique challenge, but not one that cannot be overcome with creative and thrifty solutions like using free software and inexpensive Chromebooks. Incorporating problem solving and critical thinking from a pedagogical viewpoint also presents a set of challenges, especially when the activities and content in schools are meant to connect to the real world. It is very difficult and potentially time consuming for teachers to simulate and meaningfully address intricate societal problems in a way that will lead students to provide authentic, realistic solutions to messy and complex problems. These challenges however, should not be avoided, and it is important that young people are prepared for life filled with large complex problems.

***Innovation, creativity, and entrepreneurship.*** This section of the Ministry of Education document (2016) addresses the current state of the Canadian economy, the competitiveness of the job force, and the competencies needed to be a productive member of the workforce over the next decade. Entrepreneurship is initially defined as “the process of creating and implementing innovative ideas to address economic opportunities or social problems” (Ministry of Education, 2016, p. 19). The idea that addressing social problems through innovation and creativity is an excellent way to think about entrepreneurship, and this is closely linked to the DMA’s human-centered design approach. The idea that entrepreneurship is linked to social change is unfortunately brief and the discussion takes a turn towards entrepreneurship as an individualized mindset. From the viewpoint of DMA’s focus of projects with a purpose and user empathy, it is unfortunate that the Ministry of Education document deals only briefly with the link between entrepreneurship and social change before turning towards individualism and

financial success. This style of success is placed into the context of the workforce and described as follows (Ministry of Education, 2016):

Whether you work for a ten-person company, a giant multinational corporation, a not-for-profit, a government agency, or any type of organization in between – if you want to seize the new opportunities and meet the challenges of today’s fractured landscape, you need to think and act like you’re running a start-up. ( p. 19)

It is important that students begin to develop a sense of agency when thinking about the future, but this style of entrepreneurship seems far more egocentric than it needs to be; and after all, not every Ontario student will grow up to be his or her own boss. Instead, entrepreneurship as a mindset could be tied closer to a style of working and learning that breeds positive social change and teaches empathy. An entrepreneur in the 21<sup>st</sup> century could easily create and run a series of startup companies that are detrimental to the natural environment and society. It is time that large and complex issues are addressed in every facet of 21<sup>st</sup> century learning and developing entrepreneurial mindsets without key ingredients like empathy, honesty, and compassion could be harmful to society. It would be of great benefit to Ontario students if entrepreneurship was taught with a specific focus on the human-centered design approach referenced by the DMA and ISTE. In a time of overwhelming technological advancements and change, it is important to intertwine character education into the realm of new media.

***Communication and collaboration.*** The Ministry of Education (2016) recognizes that digital tools “represent a new realm of communications interaction” and see the value in incorporating new digital tools into the classroom (p. 12). This document makes brief mention of some tools that could enhance communication and collaboration and they include 3D

printers, video/music production tools, virtual worlds, and interactive games (Ministry of Education, 2016, p. 36). The document includes ideas, tools, and suggestions but does not explain or justify their importance or provide context for the reader. The following image was placed without context or introduction, presumably to demonstrate a robotics project (Ministry of Education, 2016):

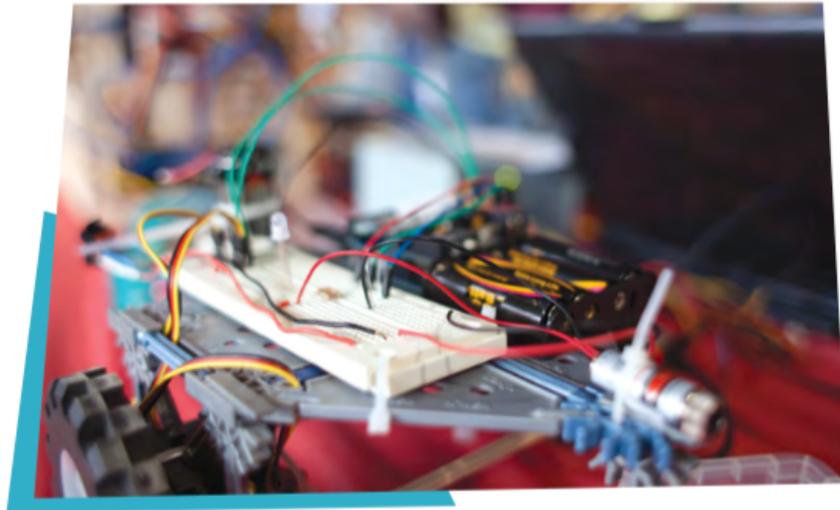


Figure 9. Robotics Representation (Ministry of Education, 2016, p. 25)

There is also brief mention of storytelling, but it is only represented through presentation tools and video and music production tools. As the primary research of this thesis discovered, in the viewpoint of professionals who create curriculum for out-of-school technology academies like DMA, digital storytelling is an incredibly powerful activity for young people and can be achieved through many different digital media platforms. Although *21<sup>st</sup> Century Competencies* (Ministry of Education, 2016) references storytelling, it does not connect to app development, computer coding, or game development.

**A growth mindset.** The greatest similarity between this Ministry of Education (2016) document and the information discovered from this thesis is the emphasis on mind-set, or more specifically, Carol Dweck's (2006) growth mindset. The Ministry of Education found through research, "competencies associated with metacognition and a growth mindset are essential for ongoing success in the 21<sup>st</sup> century" (Ministry of Education, 2016, p. 16). This document also recognizes that students' mind-sets "have a direct influence on their grades and that teaching students to have a growth mind-set raises their grades and achievement test scores significantly" (Ministry of Education, 2016, p. 15). With mental health awareness on the rise, it is important to address confidence and mindset with young people and make that connection to new media. The interviewees at the DMA linked a growth mindset, grit, and perseverance directly to failure as learning and this is something that could be emphasized more clearly in the Ministry of Education document in order to align it with the 21<sup>st</sup> century skills identified by the DMA curriculum developers.

**Local, global, and digital citizenship.** The Ministry of Education quoted Fullan and Langworthy (2014) and described citizenship as, "global knowledge, sensitivity to and respect for other cultures, and active involvement in addressing issues of human and environmental sustainability" (Ministry of Education, 2016, p. 17). The key distinction in this definition is active involvement and it is important that young people learn how to be active, rather than passive, consumers and producers of new forms of media. The Ministry of Education recognizes that technology is changing the "landscape of civic education in the 21<sup>st</sup> century" but it also recognizes that civic education appears late in the grades 9 and 10 *Canadian and World Studies curriculum*. The Ministry of Education uses the term, *social progress*, to describe the role of

teaching citizenship to young people. At the DMA, social progress is taught through their human-centered design approach and this helps bridge the gap between citizenship and new technologies. The Ministry of Education has discussed citizenship and digital citizenship without making a strong connection between the two. New technologies give students the opportunity to connect and interact with classrooms across the globe and it would be a disservice to young people if new technologies were not considered to be tightly linked with social progress.

Ontario students need new technologies to be framed in the context of social progress, social change, and citizenship. Young people can no longer just view new technologies as windows to information and virtual opportunities for leisure, but need to view technology as a medium to produce content for positive, global, local, and social progress.

### **Limitations of the Study**

This thesis is intended to spark a discussion about the future of Ontario education that draws insights from the work of the Digital Media Academy. The DMA operates out of the Silicon Valley area where tech giants like Apple, Google, Netflix, and Facebook are based; although this area of California provides cutting edge and innovative perspectives on new media, it is only one setting and a highly privileged one at that. Thus, the perspectives raised here would benefit greatly from comparative studies undertaken elsewhere, perhaps other non-formal learning environments elsewhere in North America that serve underrepresented populations. Though the findings from this thesis may not resonate with all contexts and sites, they should still spark a conversation about the future of schooling in the ever-changing technological landscape.

## Questions for Future Research

The Ministry of Education's 21<sup>st</sup> Century Competencies (Ministry of Education, 2016) and the information extracted from this thesis demonstrate the need for a comprehensive digital literacy program in Ontario. The Ministry of Education does a great job sparking a new discussion that is incredibly important for the future of education, but has not officially reported any primary research that gives context to 21<sup>st</sup> century education and the ways in which it will be implemented into the classroom.

Through a combination of the findings from this thesis and the release of *21<sup>st</sup> Century Competencies* (2016) by the Ministry of Education, the following questions have been curated for the purposes of future research:

1. How can students use technology in the formal classroom to be creators that actively participate in solving real-world issues?
2. How can teachers be encouraged and supported to transform their teaching approaches to accommodate 21st Century literacies?
3. How could Ontario Bachelor of Education programs adapt their programming to prepare teachers for the 21<sup>st</sup> century classroom?

New technologies will shape the way teachers and curriculum developers view 21<sup>st</sup> century skills and competencies. In addition to being the home of The Digital Media Academy's comprehensive program, the Bay Area of San Francisco is also host to *AltSchool*, an innovative series of *project-based learning* schools that run similarly to a modern Montessori school (Ark, 2017). The *AltSchool* runs off of a unique curriculum that aims to holistically educate and prepare students for life in the 21<sup>st</sup> century through a unique daily structure, immersive

learning environment, and 1:1 ratio of technology (Ark, 2017). Critically evaluating the emergence of innovative education projects in Silicon Valley and elsewhere can provide valuable insights for Ontario education and help to manage the ever-changing technological landscape of our century. The Ministry of Education's *21<sup>st</sup> Century Competencies* (2016) will spark a great deal of conversation and expert perspective that may result in a well-defined and well-designed program for Ontario students. Ontario educators should not look to replace the inherited curriculum wholesale, but to find new and innovative ways to rethink teaching processes and outcomes that view technology not as a hindrance, but as vehicle for teaching 21<sup>st</sup> century skills and competencies.

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## Appendices

## Appendix A: Description and Cover letter

### What can educators learn from the specialized digital literacy teaching and learning at the Digital Media Academy?

Dear Potential Participant,

The purpose of this letter is to provide information about my Master's Thesis program. I would like to invite you to take part in an interview that will help me understand curriculum and pedagogy at the Digital Media Academy. I have chosen you to participate because I believe your experience and expertise will strengthen my understanding of digital literacy inside and outside of schools. If you choose to participate, your enrollment is completely voluntary and you may withdraw at any point.

**Description of the project:** This Master's study explores digital teaching and learning in the Ontario public school system. The Digital Media Academy focuses on specialized digital literacy and media curriculum that could yield insights into appropriate and meaningful digital instruction. The focus of this study will be to identify tools and strategies from the Digital Media Academy that could enhance digital literacy instruction in the formal Ontario classroom. My research question asks, "what can Ontario K-12 educators learn from the specialized digital literacy teaching and learning at the Digital Media Academy?"

**Interviews:** Interviews are estimated to last anywhere between 20 – 45 minutes. The length and direction of the interview is up to your discretion since it is a semi-structured interview, meant for you to be able to share what you think is most important. Participation is voluntary and you are under no obligation to be interviewed. If you agree to be interviewed you may refuse to answer any question, and you may stop at any time. Interviews will be conducted in various locations across North America, as they will be performed using the online video chat application, Google Hangouts.

I will ask you seven general questions about the teaching and learning environment at the Digital Media Academy. If you agree, I will audio-record the interviews. If you wish not to be audio recorded, you may indicate that notes can be taken during the interview.

**Risks & Benefits :** No known risk is associated with participation in the research. There will be no direct benefit to participate in this research. The potential benefits to the participants are intrinsic, a sense of fulfillment for giving back to the field of Education. The results of my findings may also provide the developers with new insights on how to connect the specialized digital literacy curriculum at the Digital Media Academy to the more formal classrooms. The potential societal benefits are also substantial; the findings could contribute to the development of new digital literacy practices and pedagogies in school communities.

**Confidentiality & Data Storage:** You may choose to have your name used in the research or for it to remain confidential. Pseudonyms or general statements will be used when I present your views if you choose to keep your name confidential. All interview data will be password-protected and/or encrypted during the study, accessed by only Matthew Starcevic and Michael Hoechsmann, and then safely stored at Lakehead University for a period of five years.

**Research Results:** Research results will be shared in various forms including a Master's of Education thesis at Lakehead University and through online professional networks. Pseudonyms will be used unless expressed otherwise on the consent form.

You will be provided a copy of the thesis once it has been approved by Lakehead University. This will be shared through email as a PDF attachment.

## Appendix B: Contact Information

**What can educators learn from the specialized digital literacy teaching and learning at the Digital Media Academy?**

### CONTACT INFORMATION

#### **The research is being conducted by:**

Matthew Starcevic    Master's Student, Faculty of Education  
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Dr. Michael Hoechsmann

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tel: 705 330 4008 x 2640

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This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or [research@lakeheadu.ca](mailto:research@lakeheadu.ca)

## Appendix C: Consent Form

### Lakehead University Digital Media Academy Interviews: Consent Form

**What can educators learn from the specialized digital literacy teaching and learning at the Digital Media Academy?**

I, \_\_\_\_\_, (participant name) have read and understood the above information, including the potential risks and benefits of the study. I hereby consent to my participation in the research.

I understand:

- The potential risks and benefits of the study;
- I may withdraw from the research at any point during the data collection period;
- I may choose not to answer any questions;
- All information gathered will be treated confidentially;
- All data will be securely stored by Lakehead University for a minimum of 5 years following the completion of the project
- The project will be made available to me once it has been submitted and approved by Lakehead University

Please put an "X" in the box to highlight your preference.

I consent to the interview being  
audio-recorded

**or**

I would prefer that notes are taken

I would like to remain anonymous  
in presentations and writing about  
this research

**or**

I would like my name used  
in presentations and writing about  
this research

\_\_\_\_\_  
Signature of the participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of the Researcher

\_\_\_\_\_  
Date