To Infinity and Beyond:
Engaging Students Through Media and Technology

by

Belinda Jane Scott

B.Ed., University of British Columbia, 1992
B.A. University of British Columbia, 1990

A Project Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF EDUCATION

in

The Department of Curriculum and Pedagogy
(Media & Technology Studies)
(Digital Learning & Curriculum Cohort)

The Faculty of Graduate & Postdoctoral Studies

THE UNIVERSITY OF BRITISH COLUMBIA
(Vancouver)

June 2017

Abstract

This research explores how teachers can increase student engagement through the use of media and technology. In the school district where I work there was a desire for change in how we were engaging students. As a result, in the fall of 2014, the Board of Education commissioned the "Teaching and Learning in Diverse Classrooms Working Group" to engage district partners in a discussion that would guide a strategic plan focused on student success. My school district chose to use innovation grants and professional learning communities (PLCs) as a way to encourage teacher inquiry in two of the four identified themes: 1) engagement and personalized learning, and 2) communicating student learning.

This research study involved three PLCs and their proposed inquiry projects had two major purposes: 1) to examine how to improve student engagement behaviourally, cognitively, and emotionally through the use of FreshGrade as an assessment tool, a 3D printer as a design tool in the cross-curricular field of STEAM (Science, Technology, Engineering, Art, and Mathematics), and Google Suite for Education as a collaboration tool, and 2) to examine how PLCs can be used to support teacher inquiry by incorporating media and technology in their pedagogy. The study was conducted at the elementary and middle school levels. The research study involved eight teachers, 286 students in eight classrooms ranging from grades 3 to 8, and six administrators. The study took place from September 2014 to June 2017. Chromebooks, iPad devices, iPod devices, and a 3D printer were the main digital tools used in the research inquiry.

Findings related to how teachers were able to increase student engagement emerged in three areas: presence of a teacher champion, effective PLC, and equitable and adequate access to media and technology. Without these three factors in place, all three PLCs felt that student engagement would neither increase nor would teachers be inclined to use media and technology

in their teaching practice. This study concludes that the digital platform used needs to be efficient, relevant and focused. Future studies are being undertaken to research how the teachers can be mentors in the use of media and technology and ways to strengthen the role of PLCs.

Contents

List of Figures:

Tables

"Change will not come if we wait for some other person or some other time. We are the ones we've been waiting for. We are the change that we seek"

— Barack Obama, 2008

Introduction

We live in a world of constant change. The world that the teachers of today grew up in is different from the world of the children we are teaching and it will look different for the next generation. The students we are teaching today are not the same students our current education system was designed to teach; hence, how we prepare students for life outside of school needs to change. Key features of the differences teachers encounter include: how media and technology have altered the way information is shared and processed, how information is readily accessible, and how communication is immediate. Public education must be transformed to take advantage of these changes and to prepare our students for success. My school district is in the process of transformation to better prepare our students for a rapidly changing world.

My district realized that we cannot be resistant to change. We are the change we seek. As a result, senior administration embarked on a visioning journey that would inform a strategic plan focused on student success through the delivery of high quality educational programming and a personalized approach to meet the needs of our diverse learners. Education partner representatives, Board of Education members, senior management, principals and vice-principals, teachers, support staff, parents, and students, all brought their district experiences and engaged in an in-depth discussion over several months focused on, "Teaching and Learning in Diverse Classrooms" (TLDC). Four themes emerged from the discussions and literature review:

Engagement and Personalized Learning; Social Emotional Well-Being and Healthy Lifestyles; Communicating Student Learning; and Technology and Learning. Goals, priorities, and an action plan were identified for each theme.

One of the key statements developed was, "We believe that technology provides the opportunity to enhance learning and engagement." Acting on this key statement and several other statements from the review, our senior administration team has, over the past school year, supported teams of teachers to engage in teacher inquiry in one of two topics: increasing student engagement and communicating student learning. As a result of this initiative, and in my role as a district administrator, I chose the following research topics:

1. How can the use of media and technology increase student engagement in the classroom?
2. How could the creation of PLCs or innovation grants be used to support teacher inquiry in incorporating media and technology in their pedagogy?

Technology and media have become key terms in teacher pedagogy. It is recognized that in order for students to be 21st century learners they will need ICT-rich learning environments as a prerequisite to 21st century models of learning (Milton, 2015). However, "the end game is not more classroom technology; it is about fostering creative and innovative minds" (C21 Canada, 2012, p. 5).

The problem I had experienced in the past, as a Universal Design for Learning (UDL) facilitator, was watching teachers adopt technology solely so that they could receive the technology in the classroom (e.g. SmartBoards) without changing how they were teaching and engaging their students. The newly acquired technology would then be used as a substitute for another tool. For example, have students complete a word-processed quiz on a computer or

reading a text online instead of using a book. It is for this reason I chose to research how student engagement could be increased in such a way that the media and technology used were not a substitution, but were instead a redefinition of how teachers were engaging students.

Inquiry Project Description

In my research study, I chose to examine how could the use of media and technology increase student engagement in the classroom. I also wanted to examine how the creation of PLCs could be used to support teacher inquiry in incorporating media and technology from a pedagogical perspective. The final goal within the research study was to support teachers to be able to mentor their colleagues to explore using media and technology in their pedagogy through PLCs. The three school teams I chose to complete my research with conducted their inquiry on: a) communicating student learning using FreshGrade; b) increasing student engagement through the use of a 3D printer in the areas of STEAM; and c) increasing student engagement and achievement through the use of G Suite formerly known as Google Apps for Education (GAFE).

When developing my research study, I used the following questions to help guide my thinking:

> What if we could create a learning model that naturally and authentically improves student achievement in literacy, numeracy, and science, and provides our youth with modern competencies and life skills needed to succeed in a future we can only imagine? What if we could offer learning experiences to our youth that ignite their creativity and engages them in their own learning? What if we could harness the digital tools of today's world to provide higher quality learning experiences and opportunities for our children, in a more cost effective and efficient manner? (C21 Canada, 2015, p. 3)

Innovation Grant: S1 Elementary

S1 Elementary, which opened in September 2014, is a Kindergarten to grade 5 school with approximately 475 students. The school offers both Early French Immersion and regular programming. It was the first school in our district to have Wi-Fi as none of our schools had Wi-Fi capability until the 2016-2017 school year. The school provides a breakfast and lunch program and has a very active Parent Advisory Committee. The school also has a Neighbourhood Learning Centre which houses a daycare, before and after school care, and a multi-purpose room which is used for community gatherings and after school activities.

At S1 Elementary the goal was to use FreshGrade (e-portfolio) as a formative assessment tool to demonstrate, assess, and share student learning in our classrooms. Through e-portfolios, the teachers hoped to:

1. Improve student ownership of and for learning by transforming learning through assessment.
2. Give parents a window into their child's classrooms by providing opportunities to engage with their child's progress in a timely manner. E-portfolios would allow communication to be increasingly frequent, informative (e.g., showing rubrics and ministry standards) and personalized (e.g., photos, video, and student self-reflections).
3. Inform the teachers' practice to more efficiently guide their students to meet their learning needs.
4. Increase students' academic and social/emotional engagement.

FreshGrade is a tool to capture, document, and communicate learning through digital portfolios (Figure 1).

Figure 1. FreshGrade logo and view of a page. From FreshGrade media kit (2016) https://www.freshgrade.com/media-kit/

FreshGrade allows for students to have a voice in their learning. Three teachers were involved in this research study: T1 who taught a grade 5 class with 29 students, T2 who taught a grade 3/4 class with 23 students, and T3 who taught a grade 3 class with 24 students. In addition, both the principal and the vice-principal were part of the PLC. The parents were also a very important part of the research study.

As S1 Elementary is a diverse, inner city school, the parent population is often unable to interact with their child's school experiences during common school hours due to complex demands of their home life. The teachers felt that through the use of e-portfolios, parents had a better opportunity to engage with their child's school journey. Parents would be able to communicate their thoughts and opinions about their child's progress; therefore, creating a collaborative learning platform between school and home.

Research shows that parental involvement is a significant indicator in a child's academic performance at school (Topor, Keane, Shelton, & Calkins, 2010). As such, providing a means for parents to become more engaged in the assessment process would serve to increase "a parent's positive attitude about their child's education and demonstrate to parents that their attitude is related to their child's academic performance" (Topor et al., 2010). Engaging parents through e-

portfolios also served to strengthen the relationship between home and school, and between the students, teachers and parents, thus creating a team of engagement, learning, and support.

Innovation Grant: S2 Middle

S2 Middle has just over 600 students from grades 6 to 8 and offers French Immersion and regular programming. S2 follows the middle school cornerstones where each home base class is part of a team of either two, three or four classes. Students are also enrolled in exploratory classes that provide students with real life, hands-on experiences in a variety of areas. At S2 Middle the goal was to inspire, motivate and engage students in the cross-curricular field of STEAM through the use of a 3D printer (Figure 2).

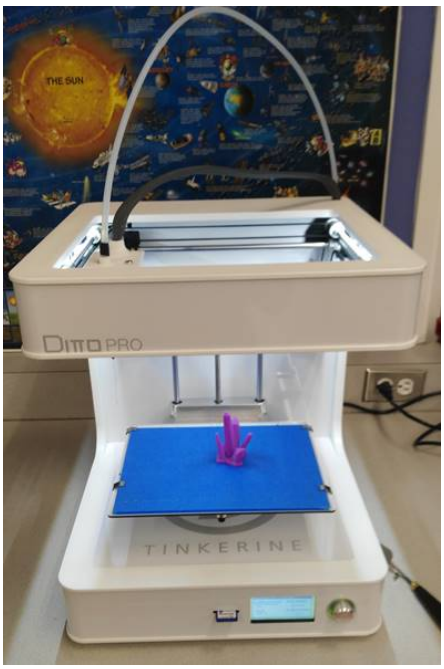


Figure 2. Photo of Tinkerine 3D printer at S2 Middle

The technology of 3D printers would prepare students for a world in which 3D printers are already used to manufacture products in many industries with everyday life applications. The 3D printer would stimulate students' interest and motivation, thereby enriching both the

curriculum (in STEAM and applied design, skills and technologies) and core competencies, especially creative and critical thinking, but also communication and personal and social competencies.

The main driving force behind this research study was T4 who taught Math and Science. In addition, the grade eight French Immersion teachers (six), the vice-principal, and the principal were part of the innovation team study for a total of nine educators and 94 students.

Innovation Study 3: S3 Middle

S3 Middle School has approximately 250 students from grades 5 to 8. S3 Middle is a community school which has a unique community feel due to its isolation from the rest of the school district. S3 offers a breakfast and lunch program and has a close relationship with the feeder elementary school and community center which are both close by.

The goal of their inquiry project was to use G Suite for Education, specifically Google Classroom, Google Docs, and Google Slides, to encourage students to work collaboratively (Figure 3).

Figure 3. Google Classroom, Google Docs, and Google Slides. From G Suite for Education (2016) https://gsuite.google.com/setup/resources/logos/

The overarching goal was to improve student engagement. The goal for encouraging students to work collaboratively was driven by the desire to teach students about how their work and interest in what they are learning increases through collaborative work.

The S3 teaching staff work very closely together and decided as team to engage in this research study. Four teachers and 106 students were involved in this research study. There were two grade 6/7 and two grade 8 classes involved in the inquiry project with an average class size of 26 students. T5 was the champion of this inquiry project and led the school team throughout. In addition, the principal of the school was involved in the research study.

Professional Learning Communities

In an effort to become more involved in the innovation grants, I wanted to explore how to use PLC to support teacher inquiry. The innovation grant teams would naturally become the PLCs as they were united with a shared vision. In my previous position as a UDL Facilitator, I found that I had the most success with implementing UDL design ideas when I used a similar model. Over five years our UDL PLC was very successful and we had upwards of 100 teachers involved at all school levels.

As mentioned earlier, my school district offered teachers the opportunity to engage in teacher inquiry through innovation grants. Teams of teachers applied for grants through an application process. The innovation grant teams had to submit a proposal including:

1. List of participants;
2. In-depth inquiry/action research question and project outline;
3. Research/evidence to support the in-depth inquiry/action research project;
4. Measurable outcomes;
5. Amount of funds requested with a budget of intended expenses

(Appendix A: Innovations Grant Application). In total, there were inquiry proposals. Thirteen of the teams included the use of technology in their proposal. One of the barriers faced by the teams

was accessibility to Wi-Fi and access to the technology they wanted to purchase. For six of the teams, the technology was not purchased until several months later forcing the teams to delay the start of their inquiry for a year.

I chose to research three teams who had the desired technology in place and were ready to start in the early fall of the school year. The district set two mandatory meetings, one at the start of the year and one at the end of the year, in which the innovation grant teams would meet. The individual school teams were responsible for setting up their own regular meetings. I met with two out of the three schools, S1 and S3, but only in a very limited way. Although I met with the leader of the S2 team, I was unable to connect with the whole school team in any meaningful way.

I used the findings from my literature review to help guide what my role would look like in the PLCs. According to Clarke (2014, p. 31), a successful PLC used the following themes "of collaboration, shared vision, leadership, and collective focus on students learning" as a guide when developing their plans of action. The school based innovation grant teams or PLCs (I will refer to the teams as PLCs from this point forward) were collaborative, had a shared vision, and had a collective focus on student learning. Leadership, however, came from the teachers at the schools and, overtime, I discovered that my role did not play as large of a role in the PLCs due to various reasons which will be explained in the future considerations section of this paper.

As I developed my vision of what an effective inquiry project, using media and technology, would look like I used the learning framework from the *Shifting Minds: A 21st Century Vision of Public Education for Canada* (C21 Canada, 2015) (Figure 4).

Figure 4. Cover of the Shifting Minds 3.0 publication from C21 Canada (2017) http://www.c21canada.org/wp-content/uploads/2015/05/C21-ShiftingMinds-3.pdf

C21 Canada outlined the guiding principles and competencies educators need to follow in order to transform education in Canada.

> Members of C21 Canada understand that while the rapid expansion of digital capacity has fueled profound change, it is not just about technology; it is how one is able to use technology to attain the competencies required for economic, social, environmental, financial and personal growth and progress. The end game is not more classroom technology; it is about fostering creative and innovative minds. (C21 Canada, 2012, p. 5)

The end game for the inquiry projects was to improve student engagement; it was not just about technology.

I also referred to *The Spiral Playbook: Leading with an Inquiring Mindset in School Systems and Schools* by Linda Kaser and Judy Halbert (2017) (Figure 5).

Figure 5. Title of the Spiral Playbook. From C21 Canada (2017) http://www.c21canada.org/

In the book, references are made to the Organization for Economic Cooperation and Development (OECD) and the seven principles that were identified for developing lifelong learners in society. Principles such as: a) put learners at the centre; b) emphasize the social nature of learning; c) recognize individual differences; and d) use assessment for learning, were given as suggestions to guide the development of the inquiry projects (Kaser & Halbert, 2015, p. 13).

Literature Review and Key Concepts

Increasing student engagement and using media and technology in schools are key elements of educational transformation, and PLCs are considered to be a model that can bring such reform from within a school community. While reviewing the literature of these three key concepts: student engagement, using media and technology to increase student engagement, and PLCs, I found a mix of qualitative and quantitative research, although the vast majority of the research was qualitative. While there is significant research on student engagement and media and technology at the university and college level, the focus of my review was on the kindergarten to grade 12 school setting with a more specific focus on the middle school grades.

I was interested in examining the interrelationship between student engagement, media and technology, and PLCs (Figure 6).

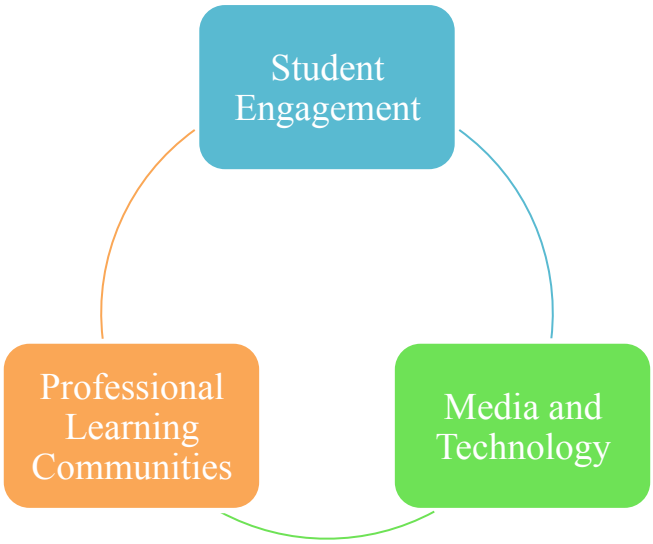


Figure 6. Key concepts. Model of student engagement, media and technology, and PLCs (2016)

My research study involved finding the answers to the following questions:

1. How can the use of media and technology increase student engagement in the classroom?

2. How could the creation of PLCs and innovation grants be used to support teacher inquiry in incorporating media and technology in their pedagogy?

In my review of student engagement, I examined the three domains of engagement and how it is assessed. A one-size-fits-all kind of study or assessment does not accurately assess student engagement and further research needs to be done on the best way to do so while keeping the different domains — emotional, behavioural, and cognitive — in mind. Secondly, since media and technology, as a key concept, could be a doctoral dissertation, I focused my review on how media and technology can be used to increase student engagement. Again, I discovered that further research needs to be done, using empirical data, to demonstrate that the use of media and

technology does in fact improve student engagement and student achievement. My final key concept, PLC, was also narrowed down to look at what role does an administrator play in PLCs.

When searching for literature on my key topics I chose to narrow my search using the following terms:

- "media and technology" AND "student engagement"
- "student engagement" AND "assessment"
- "PLCs" AND "administration" OR "principal"

My selection criteria and summary of the articles I chose to review are included in Tables 1- 4 (Appendix B: Summary of Literature Reviewed).

Media and Technology

The literature I reviewed supported the use of technology as having the potential to be transformative for teaching and learning. "Students need opportunities to develop competencies required to use current and emerging technologies effectively in all aspects of their learning and life" (BC Ministry of Education, 2015). As technology and media are a key part of the redesigned curriculum and my research study, it was imperative for me to review this key concept. "Technologies and technological curricula refer to devices, media, processes, symbols, cyborgs and robots, cyberspace, and knowledge as well as to disciplines, specializations, and the volition animating these things" (Petrina & Rusnak, 2011, p. 877). Furthermore, Arntzen, Krug, and Wen argued that "digital technologies are more than simple machines or *tools*. Computer hardware, software, and infrastructure are complex technological devices" (2008, p. 2). Arntzen, Krug, and Wen also proposed that we use more specific terminology when referring to media and technology or information and communication technologies (ICTs) (2008). It is through this

lens that I have used language that refers to the specific ICTs used by teachers in their inquiry projects.

In the *Oxford English Dictionary* media is defined as the “main means of mass communication (broadcasting, publishing, and the Internet) regarded collectively" (OED, 2017). In this sense, media includes symbol systems as diverse as print, graphics, audio, videos, and nonverbal behaviours.

Students today have spent their entire lives surrounded by media and technology. The use of media and technology is a valuable opportunity to find novel and innovative ways to engage students in their learning (Downes & Bishop, 2012; Fullan 2012; Wilson & Boldemann, 2011). Students are immersed in technology. They find answers and connect with their peers within seconds using Google, Instagram, Snapchat, YouTube, Facebook, text, and through gaming.

In a six-year study, Downes and Bishop explored what engaging middle school learners through technology might look like. The findings showed that technology made learning more fun and enjoyable. Technology allowed for collaboration, opportunities for creativity, taught students how to use their time efficient, and helped students to be more organized (2012). The middle school students in the study "were also quick to point out that their engagement in learning did not necessarily end with the school day. They felt the technology made it easier to continue their learning at home, either after school or if they were absent that day" (Downes & Bishop, 2012, p. 11). Similar findings were reported by Wilson and Boldeman in their four-year longitudinal study (2011) and in the study by Banitt, Theis and Van Leeuwe (2013).

In order to effectively integrate technology into education, we as teachers must learn to bridge the gap between ourselves as “digital immigrants” and our students. We need to change our methodologies and what we teach. The outdated transmission model through which teachers

transmit facts and knowledge with textbooks and lectures is no longer effective. Youth are hard wired to the digital landscape, and we need to "transform public education to ensure relevancy for today's modern learner" (C21 Canada, 2015, p. 4). According to C21 Canada, we need to shift our minds. This includes the understanding that "we need to shift what we teach and how we teach to engage, empower, and position learners for success" (C21 Canada, 2015, p. 5). This shift in the way we teach involves examining the use of media and technology in teacher pedagogy.

How can teachers effectively use media and technology to engage students? Researchers have examined how student engagement can increase with the use of media and technology by researching factors such as teacher preparedness and teacher environment, students as collaborators and as leaders in their own learning, opportunities for creativity and critical thinking, and logistical issues such as Internet access and access to software and hardware.

Teacher preparedness and teacher environment play the largest role in increasing student engagement with media and technology. Teachers who want to use technology need to be willing to take risks. They need to be flexible, and they need to know when and how to learn from other people. Teachers also need to be willing to commit to using technology in their classrooms (Wepner & Tao, 2002, p. 249). A variety of studies have indicated that media and technology will not be effective unless teachers are adequately prepared and supported (Ertmer & Ottenbreit-Leftwich, 2010; Gorder 2008; Wepner & Tao, 2002). "Teachers need to know *how* and *why* to use technology in meaningful ways in the learning process for technology integration to work" (Gorder, 2009, p. 64).

In my experience, one way to increase student engagement and to bridge the gap between students who are comfortable with technology and students who are not comfortable with

technology is to collaborate with students on the journey to discover the effectiveness of digital technologies. Wilson and Boldeman argued that "starting 'where young people are at' in their highly connected, technology rich life worlds might be a critical point of engagement" (2011, p. 667). Prensky (2006) also suggested that partnering with students holds the key to teaching students who are comfortable with technology. Using technology with students and learning from students allows students to take control of their learning.

"Students need opportunities to develop competencies required to use current and emerging technologies effectively in all aspects of their learning and life. Today's technology enables classrooms, communities, and experts around the world to share digitally in a learning experience, wherever they may be" (BC Ministry of Education, 2015). Qualitative research has shown that the use of media and technology does improve student engagement. Further research that is accompanied by empirical data needs to be done to demonstrate that media and technology improve student engagement and student achievement.

John Hattie (2013) reviewed the effectiveness of computer-assisted instruction and found that the effect on learning is similar to the effect on learning found from other teacher interventions on average. In other words, if media and technology are used to replace similarly effective teaching activities, the net result may be the same. The Organization for Economic Cooperation and Development (OECD) released the findings of their "internationally comparative analysis of the digital skills students have acquired, and of the learning environments designed to develop these skills" (2015, p. 3). The results of their findings showed that when computer use is related to students' skills, the correlation between the investment of ICT technologies and the performance of students' skills in reading, writing and math was weak. OECD recognized that effects are "likely to vary depending on the context and the specific uses"

(2015, p. 163). The report stressed that they are not saying schools should not be using computers but what they are saying is that teachers need to get better at how to use media and technology (OECD, 2015).

Teachers in our school district chose to explore how they could use media and technology to digitally share the learning experiences of their students, to develop competencies in ICT through a journey of discovery with their students, and to increase student engagement through the use of media and technology.

Student Engagement

Increasing student engagement is one of the key elements of educational reform and is identified as one of our priorities for our district. How student engagement is viewed and defined has changed over time from one of researching what causes disengagement to one of examining how to engage students to improve student achievement, participation, and involvement. Historically, research focused on student reengagement as a way to decrease drop-out rates. Further research looked at how to improve student engagement as a way to manage classroom behaviours (Parsons & Taylor, 2011). In this review, I examined how current research has defined and assessed student engagement. It is argued that student engagement is more than time on-task and test results. Student engagement can be viewed as a meta-construct consisting of multiple domains, varying levels of engagement and different ways of measuring and assessing student engagement. The requirements that need to exist to increase student engagement have been outlined by several researchers and will be outlined in this review.

Historically student engagement was defined from the viewpoint of disengagement. Student disengagement is defined as "the extent to which students refrain from participating in

activities offered as part of the school program, tasks of scholarship and citizenship, and extracurricular activities" (Natriello, 1984, p. 2). In the past, if a student was seen to be participating in school activities one could say they were engaged in school. Furthermore, "student engagement has primarily and historically focused upon increasing achievement, positive behaviors, and a sense of belonging in students so they might remain in school (Parsons & Taylor, 2011, p. 28).

The *Oxford English Dictionary* defines engagement as the "action of engaging, the state, condition or fact of being engaged" (OED, 2017). It is the state, condition, or fact of being engaged which has been explored by researchers and educators. What does it mean when a student is said to be engaged? Researchers, today, are trying to answer this question by looking at behavioural, cognitive, and emotional dimensions as a way to reflect the multi-faceted nature of engagement (Fredericks, Blumenfeld, & Paris, 2014; Parsons, Nuland, & Parsons, 2014; Skinner & Belmont, 1993). Other researchers included further dimensions such as social and psychological dimensions. In my review of the literature it became apparent, as it was a criticism of several researchers, that student engagement needs to be viewed from several different dimensions.

Behavioural engagement includes time on-task and active participation in class activities and is considered a major contributor to student achievement and the prevention of students dropping out of school early (Parsons, Nuland, & Parsons, 2014). Bundick, Quaglia, Corso, and Haywood defined behavioural engagement as "the various learning-and academic-oriented behaviors, actions and involvements in which students engage in school" (2014, p. 3). Research on behavioural engagement has also focused on student attitudes, interest, and values.

Emotional engagement refers to students' feelings, reactions to others and topics or tasks, and relationships to others (Bundick et al., 2014; Fredericks, Blumenfeld, & Paris, 2014; Parsons, Nuland, & Parsons, 2014). Students who are emotionally disengaged may be bored, passive, disconnected from their peers and teachers, and give up easily when given a challenging task.

Cognitive engagement, a newer construct, is defined as involving a "psychological investment in learning and mastery of academic material; desire for challenge; enacting metacognitive strategies such as planning, monitoring, and evaluating one's thinking; and self-regulation" (Bundick et al., 2014, p. 3). In my experience, cognitive engagement is displayed by those students who continue a discussion after school and at home, who do further research and bring to class what they have learned, and who are able to self-regulate by staying on task and ignoring distractions.

Numerous studies have presented findings on the definition of student engagement; however, there are gaps in research on how student engagement is measured. According to Parsons and Taylor (2011),

> researchers are beginning to ask students and teachers how *they* would measure engagement. This question is producing both interesting qualitative criteria and further definitions of engaged learning, which, consequently, have impacted how we 'assess' learning. (p. 5)

Do students need to be engaged in all the categories of engagement in order to be considered a successful, engaged student? Can a student be cognitively engaged but emotionally disengaged?

In the 1980s and 1990s student engagement was defined and measured by test results and time on-task. Student engagement may also be measured through surveys, interviews, and

questionnaires. Researchers are recognizing "student engagement is more complex than just observable behaviors" (Parsons, Nuland, & Parsons, 2014, p. 24). One may observe a student to be engaged in a task but is that engagement transferring to increased problem solving skills and higher level critical thinking skills? In addition, a student may be on task and demonstrating an understanding of the task required but not demonstrating enthusiasm to learn. The multi-faceted dimensions of engagement may not be reflected in the type of data that have been collected. Studies have combined subjects, conduct, persistence, and participation into a single scale (Fredericks, Blumenfeld, & Paris, 2014). Combining different facets of engagement makes it difficult to determine the source of engagement. By using domain specific measures, a deeper understanding of engagement and its multiple dimensions can be developed.

Students who are engaged can be described as being actively involved in their learning (Dufour & Eaker, 1999). Several factors have been found to affect student engagement including appropriately challenging tasks, authenticity of tasks, teacher behaviour, and opportunities for collaboration and self-directed learning, (Prince, 2004; Skinner & Belmont, 1993). Strong empirical support was found for a reciprocal relationship between teachers' behavior and students' engagement in the classroom. "Teachers' interactions with students predicted students' behavioral and emotional engagement in the classroom, both directly and through their effects on students' perceptions of their interactions with teachers" (Skinner & Belmont, 1993, p. 577).

The classroom climate and environment has consistently been shown to be a strong indicator of student engagement. Teachers who manage their classrooms positively, have clear expectations, are flexible, promote students' intrinsic motivation and self-regulation, and provide challenging learning activities with clear feedback have shown to have students who are more engaged (Parsons, Nuland, & Parsons, 2014; Skinner & Belmont, 1993; Skinner & Pitzer, 2012).

When defining and measuring student engagement in our school district as part of our action plan, we will need to view engagement as multi-faceted. The way we engage students must be measured using more than time on-task and student achievement results. Student engagement consists of behavioural, emotional, and cognitive dimensions. Building relationships with students is a key factor in increasing student engagement and is one of the goals of our district's action plan. Another way to increase student engagement is through the use of media and technology. Teacher use of media and technology is being supported through the creation of PLCs and innovation grants.

Professional Learning Communities

The idea of PLCs as a model where teachers engage in a collective inquiry of observation and analysis of teaching practices, which in turn stimulate further inquiry and innovation, is widely accepted throughout schools and school districts (Dewey, 1929; Dufour & Eaker, 1999; Hargreaves & Shirley, 2009). "The underlying assumption in PLCs is that peer collaboration has the potential of transforming teaching practices in ways that will bring about higher rates of student achievement" (Riveros, Newton & Burgess, 2012, p. 204). Effective PLCs can also bring about sustainable change in teacher pedagogy (Dufour & Eaker, 1999; Wood, 2007). In addition to peer collaboration, effective leadership from a strong administrator is needed as a key factor in the success of PLCs.

> A professional learning community can be defined as a community in which teachers work collaboratively to reflect on their practice, examine evidence about the relationship between practice and student outcomes, and make changes that improve

> teaching and learning for the particular students in their classes. (McLaughlin & Talbert, 2006, pp. 3-4)

Several common elements identified as characteristics of PLCs include: shared vision and values, collective inquiries that are evidence-informed rather than data-driven, collaboration, focus on student learning, continuous improvement, trust, and supportive leadership (Dufour & Eaker, 1999; Fullan, 1995; Hargreaves & Shirley, 2009; Teague & Anfara, 2012). As summarized by Clarke, "The four ideas of collaboration, shared vision, leadership, and collective focus on students learning were identified as common themes" (2014, p. 31).

Most published work on PLCs extoll the benefits of a PLC. McLaughlin and Talbert (2006) reported that PLCs lead to increased student learning. They claim the following: that PLCs have positive effects on student achievement, that there is a correlation of PLCs with teaching practices that predict student learning gains, and that there are "strong correlations of teacher learning community and student experiences of their school and class" (McLaughlin & Talbert, 2006, p. 9). Studies on the impact of PLCs have shown that teachers develop new skills and capabilities, create teachers who are willing to act and experiment, and create teachers who ask questions and test hypotheses (Dufour & Eaker, 1999).

The role of the administrator is a key element in effective PLCs. In order for educational change to take place through PLCs it is important to have an involved administrator who can provide guidance and support.

> The importance of effective leadership in any change process is well established. It is difficult to imagine implementing and sustaining a school change process through all of the inevitable setbacks and frustration without strong leadership from a competent principal. (DuFour & Eaker, 1999, p. 183)

DuFour and Eaker argued that principals must recognize their task of creating a PLC "demands less command and control and more learning and leading, less dictating and more orchestrating" (1999, p. 184).

Guidance from the administrator can be demonstrated when developing a shared vision. A shared vision needs to be meaningful and guide an organization's purpose. It must be developed with the stakeholders and not be created in isolation by administration. Developing the culture that encourages teachers who feel valued and who are committed to a shared vision takes a leader who leads from within and not from a top down approach (Couros, 2015; Fullan, 1995; Hargreaves & Shirley, 2009). "Principals of a learning community engage the faculty in the co-creation of shared vision and values. They facilitate consensus building and conflict resolution" (DuFour & Eaker, 1999, p. 184). In my experience, administrators can take on the role of making sure some of the prerequisites for a successful PLC are in place, such as providing time for collaboration, ensuring the purpose of collaboration is explicit, purchasing of materials to support teacher inquiry, and managing meeting schedules, locations and the provision of the very important snacks and drinks which, if not taken care of, can hinder the progress of a PLC.

Fullan, DuFour and Eaker (1999, p. 196) would add that administrators live with a paradox, or two competing demands: "They must have a sense of urgency about improving their schools that is balanced by the patience that will sustain them over the long haul." Administrators must fit the purpose of a PLC in with the school learning plan and must also encourage autonomy while ensuring teachers follow the shared vision and values of a school (DuFour & Eaker, 1999; Owen, 2014; Thessin & Starr, 2014).

> Principals can participate as active partners in the lesson study – or any other – professional learning process. By demonstrating a willingness to share their teaching and be seen as learners, the school leader acknowledges the value and importance of professional learning in the school. (Boss, 2001, p. 13)

Administrators who model learning are effective leaders. Furthermore, the concept of distributed leadership was a common theme in literature (Clarke, 2014; Hargreaves & Shirley, 2009). "Distributed leadership draws change *from* the everyday knowledge and capacities of staff rather than driving reforms *through* them" (Hargreaves & Shirley, 2009, p. 96). Distributed leadership encourages teachers to take a more active role in their learning and in enacting educational change.

Dufour & Eaker (1998) summarized the importance of PLCs by stating: "The most promising strategy for sustained, substantive school improvement is developing the ability of school personnel to function as professional learning communities" (p. xi). The literature reviewed identified four common themes: shared vision, collaboration, leadership, and collective focus on students learning. Student achievement could increase with PLCs that are collaborative and have set aside time to meet and learn. Leadership was identified as an essential component on the effectiveness of a PLC if that leadership being provided by an administrator is using a distributed leadership model.

Increasing student engagement is one of the key beliefs and goals in our school district. By recognizing that student engagement may take the form of behavioural, emotional, or cognitive engagement our teachers will be able to better understand how to better engage our students in their learning. Understanding how student engagement can be assessed and to assess student's engagement with the different dimensions in mind require further research and

understanding. It needs to be understood that student engagement can be assessed in more ways than time on-task or by test results. For example, we need to continue to strive to find ways to assess student engagement by looking at how a student is emotionally engaged, cognitively engaged, or both.

Tables

When starting my research on my key concepts for this literature review, I quickly discovered that my topics were too broad. I chose to narrow my focus to examine the key concepts in relation to one another. I examined media and technology from the lens of improving student engagement. I narrowed my research of engagement to student engagement as multi-faceted and how can one assess student engagement. When researching PLCs and student engagement I focused on how administrators could support PLCs. In addition, I was fortunate to have a superintendent who has a phenomenal library that I was allowed to peruse at my leisure. I found many of the books on his shelves that were recommended in my readings of journal articles. Table 1 in Appendix B: Summary of Literatures Reviewed outlines what was used to determine which books and journal articles were included and excluded. From the inclusion and exclusion criteria, I began to gather my journal articles and books. In the Appendix B: Summary of Literature Reviewed, I have also included the articles and books I felt were relevant to my research.

Methodology

Table 1: Summary of the participants in the inquiry projects

School	Project	Teachers	Students
S1 Elementary	FreshGrade	T1 T2 T3	29 grade 5 students 23 grade 3/4 students 24 grade 3 students
S2 Middle	STEAM and 3D printers	T4	94 Grade 8 French Immersion students
S3 Middle	G Suite	T5	29 grade 6/7 students 27 grade 6/7 students 30 grade 8 students 30 grade 8 students

Innovation Grant: S1 Elementary

In January of 2016, T2 and T3 visited a neighbouring school district to observe a Kindergarten teacher and her students using FreshGrade. The teachers observed FreshGrade being used with very young children. The visit also gave the teachers an opportunity to discuss with the Kindergarten teacher the successes and challenges of implementing FreshGrade. The visit helped identify the need for a permission letter signed by the parents with an explanation of the program and request for permission to post photos and videos of the students (Appendix C: FreshGrade Consent Form). Within a month most of the parents had signed the consent form and FreshGrade was launched. The three teachers conducted informal surveys through class discussions, emails home, and informal meetings with parents at the beginning of the inquiry project and at the end of the school year to assess student and parental involvement in the student's learning. The focus of the surveys was to assess how engaged student's felt they were in their learning and how engaged parents were in their children's learning.

Students and teachers used iPod devices, which were bought using money received from the S1's innovation grant, to document student learning. In addition, existing Chromebooks, iPad

devices, iPhone devices, and computers in the computer lab were used to document student learning. The teachers introduced FreshGrade to their classes using a digital projector to show the class what the platform looked like. The teachers posted assessment documentation; instructions, directions, criteria and outlines for assignments; weekly word work words (spelling); and links to review concepts, practice quizzes online (Science Probe), and extension activities in FreshGrade.

All three teachers were involved in a large group project which included a connection to the Vancouver Biennale Big Ideas project which included a visiting artist who helped the students create an art project, the exploration of recycling through the lens of the Science Curriculum, and a writing assignment which connected students to the Red Shoe Lace Campaign where students stretched their thinking to see how an ordinary item can be made extraordinary (Figure 7).

Figure 7. Biennale project. Collage of Biennale inquiry projects.

Teachers also posted assignment criteria, the learning that took place in physical education, samples of student writing, and student art work (Figure 8).

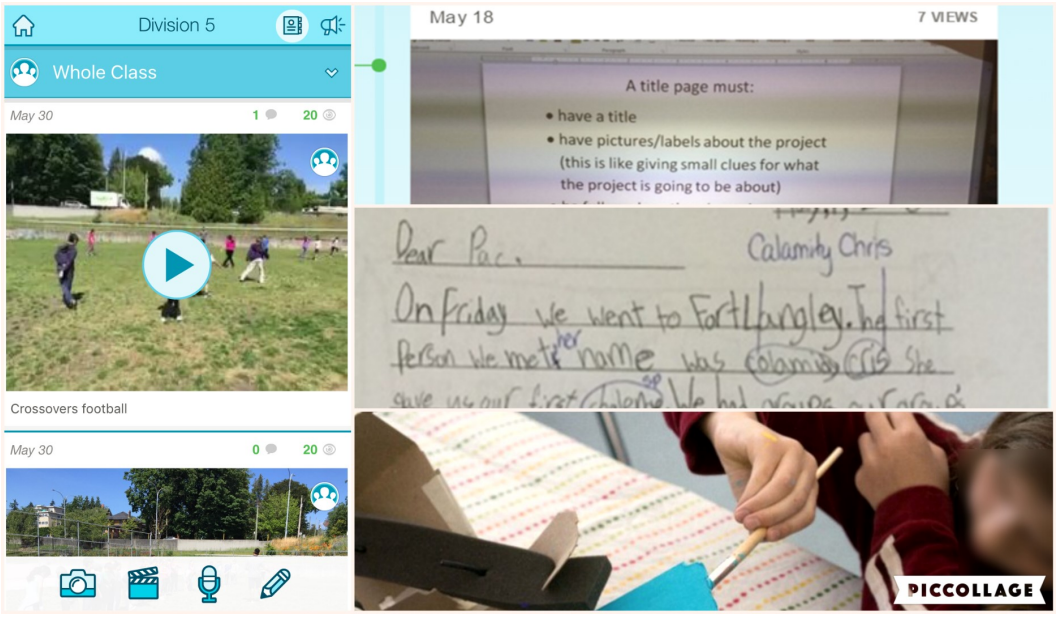


Figure 8. FreshGrade posts. Collage of FreshGrade posts by teachers and students.

At the end of the school year the teachers interviewed students and parents to get feedback on how they thought the use of FreshGrade improved student engagement in their learning and parent engagement with their child's learning.

Innovation Grant: S2 Middle

In November of 2015, the French Immersion grade 8 teachers at S2 were inspired to take advantage of the Innovation Grants to request a 3D printer to help support the implementation of STEAM. There was a slight delay in purchasing the 3D printer but in February of 2016 a Tinkerine 3D printer arrived. In addition, seven rolls of filament and five licenses of Tinkercad, a 3D modeling CAD software, were bought. T4 spent the better part of February learning how to program the 3D printer.

The Science 8 classes were assigned the Boat Challenge (Appendix D: The Boat Challenge). The unit plan was developed by the Vancouver based company Tinkerine and was part of the education package that came with the 3D printer. Before the students began the Boat Challenge they learned about density by completing experiments measuring mass and volume and calculating the density of different solids and liquids. Students had to write a laboratory report for the experiments using the scientific method.

The Boat Challenge was designed to take two days; however, due to scheduling difficulties with getting access to the school computer lab the project took longer to complete. Students were challenged to design and build a boat that would float on water, but sink in oil. They were encouraged to use the scientific method to design an experiment to find the answer before building the boat with the 3D printer and testing it.

Once the Boat Challenge was completed students were encouraged to explore inquiry projects they would like to do. The Science classes also completed a unit on atomic theory. They were encouraged to build a 3D model of an element (Figure 9), although students did not have to use the 3D printer.

Figure 9: 3D atom models. A student's 3D atom representations

T4 also started a 3D Designer Club which met during the lunch break in which ten students joined and learned how to use Tinkercad. The art teacher had the student work on an art project where students created a sculpture and then printed it in 3D (Figure 10).

Figure 10. 3D Eiffel tower model. A student's representation of the Eiffel Tower.

Research Study 2: S3 Middle

In early January 2016, three teachers visited a teacher and her class in a neighbouring district who were using FreshGrade. The visit was informative and gave the team the inspiration they needed to try FreshGrade but also Google Classroom. The school team bought two iPad devices, four iPod touch devices to capture pictures and video, a Wi-Fi hub, and ten Chromebooks.

Chromebooks were used as the foundation for research, writing, creative writing, and word processing tasks. The students also used the Chromebooks and iPad devices to access

FreshGrade, Google Docs, Google Slides and Google Classroom. This research study evolved from a research study on FreshGrade to more of a focus on Google Suite for Education.

Before starting the research study, a letter was sent home to explain to parents what the students and teachers were doing and to address some of the parents' concerns as students had logins that looked like emails. Students needed a Gmail account to access Google Docs and some parents were concerned that their children would be posting images and content on the Internet. To address these concerns, teachers asked students and parents to read and sign the Student District Technology User Agreement (Appendix E: Student District Technology User Agreement) which included guidelines on responsible use of media and technology. In addition, during the parent and teacher interviews evening, the students showed their parents how Google Suites for Education were being used.

T5 first introduced the students to Google Docs to show them the power of Google Docs and how to use the app. T5 took a constructivist approach in that she set the stage and let the students discover the power of the apps. For example, when introducing Google Docs, the teacher asked the students to type three things, on the Google Docs class list, they would rather be doing instead of being at school. As the students had never used Google Docs due to the lack of Wi-Fi in our schools, they didn't know what was going to happen next. The students quickly realized the potential of the app and began commenting on one another's choices. With Google Slides, T5 modeled how she wanted the students to build the slides and how to insert video and graphics. At first it was chaotic as there were 26 students trying to insert slides on the same slide deck. The slides were jumped around as the students inserted them. In retrospect, T5 commented that introducing Google Slides by asking each individual student to submit a slide made for a

confusing introduction; however, the students were able to work together to produce a cohesive first presentation of their favourite activities other than being at school.

Once the students were familiar with Google Docs and Google Slides, the teacher introduced the students to Google Classroom (Figure 11).

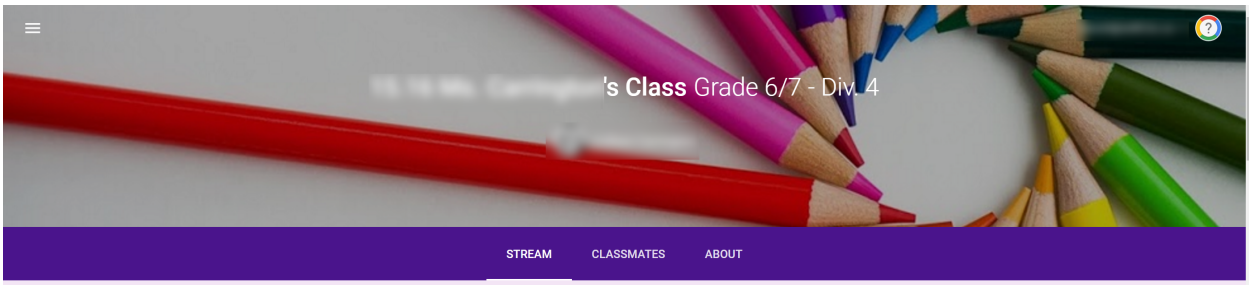


Figure 11. Google Classroom. Screen capture of T5's Google Classroom.

T5 used Google Classroom to introduce assignments and a multi-step project where students researched and wrote a collaborative research report in Google Docs and prepared a Google Slides deck for presentation to the rest of the class (Figure 12).

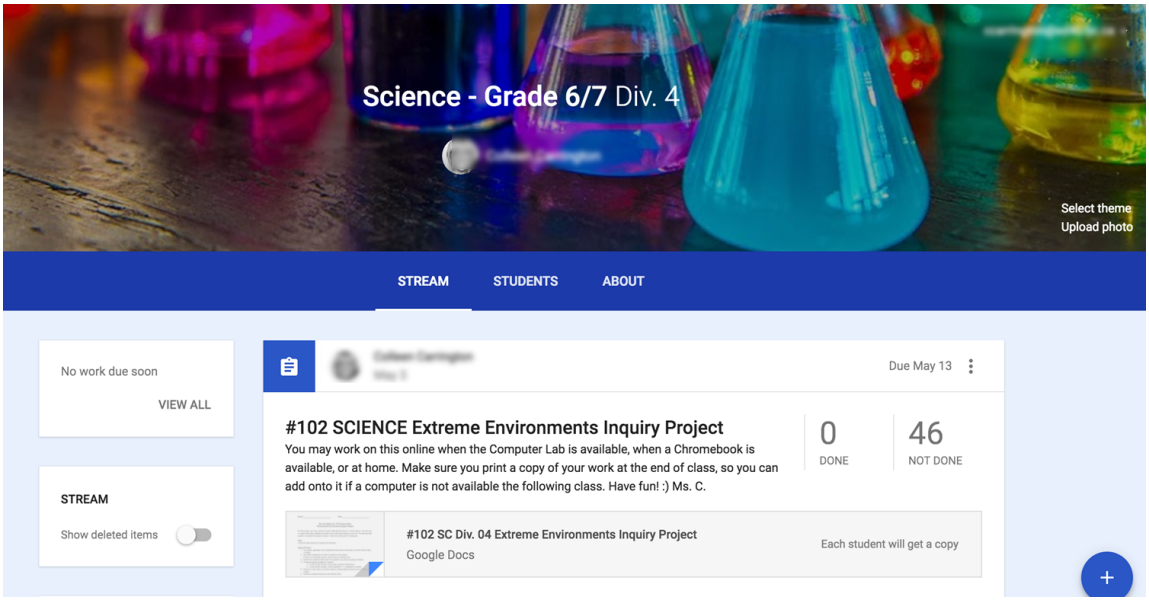


Figure 12. Science extreme environments. Screen capture of Science Extreme Environments Inquiry Project.

T5's role was to teach the students on how to use Google Suite. The other teachers in the team would continue with other projects in other subjects such as Language Arts and Socials. Students were also encouraged to complete their own inquiry projects as time allowed using whatever app suited their needs.

Professional Learning Communities

I started planning the PLCs with a clear vision which was: a) I believe technology provides the opportunity to enhance learning and engagement; and b) I believe all students should have an opportunity to access the curriculum using an inclusive model. I then used the three big-picture questions as outlined in *The Spiral Playbook* (Kaser & Halbert, 2017) to help further guide my thinking.

- What is going on for our learners?
- How do we know?
- Why does it matter?

These three questions allowed me to keep the learners at the centre of the PLCs. I knew some of our learners were not engaged in their learning, academically, cognitively, and emotionally, through the yearlong research conducted by the TLDC working group in the phase one of my research project.

The TLDC research showed that student engagement is one of the key elements of educational transformation. The focus on personalized learning and the use of technology all seek to increase student engagement, thereby leading to deeper learning and improved literacy and numeracy skills. "Generally speaking, the concept of student engagement is predicated on the belief that learning improves when students are inquisitive, interested, or inspired, and that

learning tends to suffer when students are bored, dispassionate, disaffected, or otherwise 'disengaged'" (Great Schools Partnership, 2016, para. 1).

Most of the teachers started their inquiry projects in the scanning phase by asking themselves what is really happening in their classrooms and school district. Teachers in our district were communicating student learning using the three formal report cards and two informal reports templates each school year. Students were working on collaborative projects but, at times, not all the students were engaged in the projects. In addition, students were not being given the opportunity to think creatively and demonstrate their knowledge in the area of STEAM to the degree that teachers would like.

The next phase was the focusing phase. "Where we will we concentrate our energies in order to make a big and lasting difference for our learners?" (Kaser & Halbert, 2017, p. 26). From this phase, a focusing question or statement was developed to guide each inquiry project.

Table 2: Summary of the Focusing Questions

School	**Project**	**Focusing Question or Statement**
S1 Elementary	FreshGrade	We can foster meaningful, constructive communication between students, teachers and parents using FreshGrade?
S2 Middle	STEAM and 3D printers	3D printers can provide an innovative and stimulating way of teaching STEAM (Science Technology Engineering Art and Math) projects.
S3 Middle	G Suite	Student engagement will increase through the use of online tools, Google Apps and Google Classroom to allow students to work collaboratively.

The phase that took the most of the teachers' time was the action phase. This was the phase where the teachers gathered evidence, documented the learning, and planned. At the end of the year, the teachers were asked to check their progress. Were they making a difference?

Ethical Considerations

When considering what were the ethical considerations of my research study, two main considerations came to the forefront: being aware of the ethical issues that arise with the increased use of media and technology and balancing my role as an administrator and researcher.

Our district has avoided some of the ethical issues that have arisen over the years as we were one of the few districts in the Lower Mainland area that did not offer Wi-Fi in our schools. We had very few digital tools, computers, and laptops available for student use due to crippling budget cutbacks over the past several years. We did not offer sufficient technology support or learning support to teachers for incorporating technology in the classroom. Since September 2016, many changes have taken place. Most of our schools now have Wi-Fi in the library and in some of the classrooms. The district has set aside a budget to purchase technology. We have hired three additional people to support the technology and learning needs of the teaching staff but with these changes ethical considerations have arisen.

When I first began my research study, I was concerned with how I would balance my role as an administrator with my role as a researcher. As a district administrator I am expected to uphold district policy and vision. I am also expected to guide teachers in their learning while balancing the need for autonomy in the classroom. It was fortunate that I had a good relationship with most of the teachers in the three PLCs having either taught with them or having worked with them on a previous collaborative project.

As I conducted my research study, I wanted to approach the PLCs with a ground up, discursive and collegial methodology and not a top down, administrative approach. My goal was to provide administrative guidance to the inquiry teams while respecting teacher autonomy. In addition, as an educator, I followed the professional standards and guidelines as outlined by the

BC Teacher Regulation Branch. I must value and care for all students and act in their best interests; act ethically and honestly; understand and apply knowledge of student growth and development; implement effective practices in areas of planning, instruction, assessment, evaluation and reporting; have a broad knowledge base and understand the subject areas I teach; engage in career-long learning; and contribute to my profession (BC Ministry of Education, 2012).

The standards that were of the utmost importance for me was the first three standards as they spoke to the goal of increasing student engagement in a meaningful way: 1) "Educators value and care for all students and act in their best interests; 2) Educators are role models who act ethically and honestly; 3) Educators understand and apply knowledge of student growth and development" (BC Ministry of Education, 2012). I used these guidelines to help guide me in my ethical considerations.

The teachers in the innovation grant teams expressed enthusiasm for a research project that was supported by the district both financially and through the support of a technology facilitator. All the research took place during school time or during parent and teacher interview times and was tailored to meet the needs of the students in the teacher's class. The teachers outlined identifiable, measureable outcomes that aligned with British Columbia's revised curriculum when developing their inquiry projects. Both teacher and students benefitted in mutual ways. Teachers were excited to be able to explore ways of engaging students using digital tools such as 3D printers, G Suite for Education, Chromebooks, iPad devices, and iPod devices. Students were excited to demonstrate their learning in new ways. Students' involvement in the research project was recognized through student achievement and increasing engagement in

class. Students' achievement was assessed using summative and formative assessment procedures that were appropriate for the assigned tasks.

The increased use of media and technology in the classroom raised the need to be informed of what ethical issues need to be considered when using technology. I turned to the University of British Columbia for guidance. Moll and Krug developed a social software platform "to support the teaching and learning of global citizenship in the teacher education program" at the University of British Columbia (2008, p. 108). Although not a goal of the project, Moll and Krug recognized that it was "it is important for us to have an informed view of ICT moral and ethical issues, as well as social responsibility, while recognizing the impact of ICT" in our society (2008, p. 112). Considerations such as inequality of resources, both at school and at home for students, personal privacy, confidentiality, perceived gaps between the levels of competency and comfort in the use of technology, intellectual property, and copyright policies were identified as areas of concern by the students involved in Moll and Krug's study project (2008, pp. 112-113).

Many of these same considerations arose with the teachers in my research study. The school board passed an updated Digital Technology Policy in 2015 which addressed the need to implement guidelines for the use of digital tools and social media. With the passing of the policy came the recommendation for user agreements to be developed that would address the concerns pertaining to the confidentiality and privacy of student information. Therefore, all the students and teachers involved in the inquiry projects signed a Digital Technology user agreement (Appendix E: Student District Technology User Agreement and Appendix F: Staff District Technology User Agreement). Parents were also required to review the student form with their child before signing it. By signing the form, parents were given information about how their

child would be using the tools to demonstrate their learning and parents were also given the opportunity to ask any questions that may be of concern. The agreement outlined expected behaviour online and confidentiality guidelines. In addition, all students and parents were required to sign a media, photo, and video release form that enabled teachers to share photos and videos of students and the learning that was happening in the class. (Appendix G: Media, Photo, and Video Release Form).

Teachers were cognizant of the inequality of the resources available to students and found this to be a major roadblock in their inquiry projects. In S1, access to the computer lab proved to be difficult as there were limited blocks available to book time in the lab. In S3, the teachers also reported difficulty getting equitable access to the computer lab. Furthermore, the grade 8 students had access to a Chromebook cart while the grade 6 and 7 classes did not have the same access to technology.

The teachers also tried to address the level of comfort and competency of students by building in peer support during their projects and by setting up the 3D Designer Club where students could work together on projects. In S1, the teachers found that the level of comfort and competency did impact some of the parents' ability to use FreshGrade to its fullest potential.

In terms of the privacy concerns, the teachers in S1 had the parents sign the FreshGrade consent form which included an explanation that the students' accounts were password protected and access was limited to the class exclusively (Appendix C: FreshGrade Consent Form). In addition, FreshGrade follows the regulations outlined in the Freedom of Information and Protection of Privacy Act (FIPPA) as the servers are located within Canada. In order to use Google Suites for Education, our district submitted a Privacy Impact Assessment (PIA) to the information officer of FIPPA. As a result of the submission a list or compliance orders were

outlined. One of the orders was for all students to sign the Google Apps for Educations consent form which outlined how the information was being stored and how students would be able to access the apps through a Gmail account and password (Appendix H: Google Apps for Education). As each student had their own account they could not login or use the apps anonymously and were, therefore, held accountable for their actions and what they posted.

In June 2016, the teachers who received innovation grants, met to share the outcomes of their inquiry projects. The names of students were limited to their first name only when sharing student feedback. All teachers who agreed to share their inquiry project findings did so on a voluntary basis. At the year-end sharing event the goal was for all teachers to share the successes and perhaps failures of the eighteen inquiry projects.

The ethical considerations that needed to be considered were complex and at times unexpected. Working together enabled the teachers to brainstorm strategies and solutions that they either implemented immediately or planned to implement in the fourth phase of our research study. Those strategies are outlined in the findings and future considerations sections of this paper.

Research Design

In planning the research design of this project, I used several sources to help me plan. When my district administration team developed the innovation grant guidelines we had an opening statement that stated our beliefs and aim (Appendix A: Innovation Grants Proposal):

> Inquiry is a study responding to a worthy question, issue, problem or idea. It is research/ evidence based with measurable outcomes. Inquiry/ action research is based on the belief that understanding is constructed in the process of people working and conversing

together as they pose and solve problems, and make and test discoveries that arise in the course of the shared activity.

Therefore, any research that was conducted needed to be based on our beliefs and had to be evidence based. I referred to *Shifting minds: A 21st Century Vision of Public Education for Canada* (C21 Canada, 2015) and to *The Spiral Playbook* (Kaser & Halbert, 2017) to help guide my research (Figure 13).

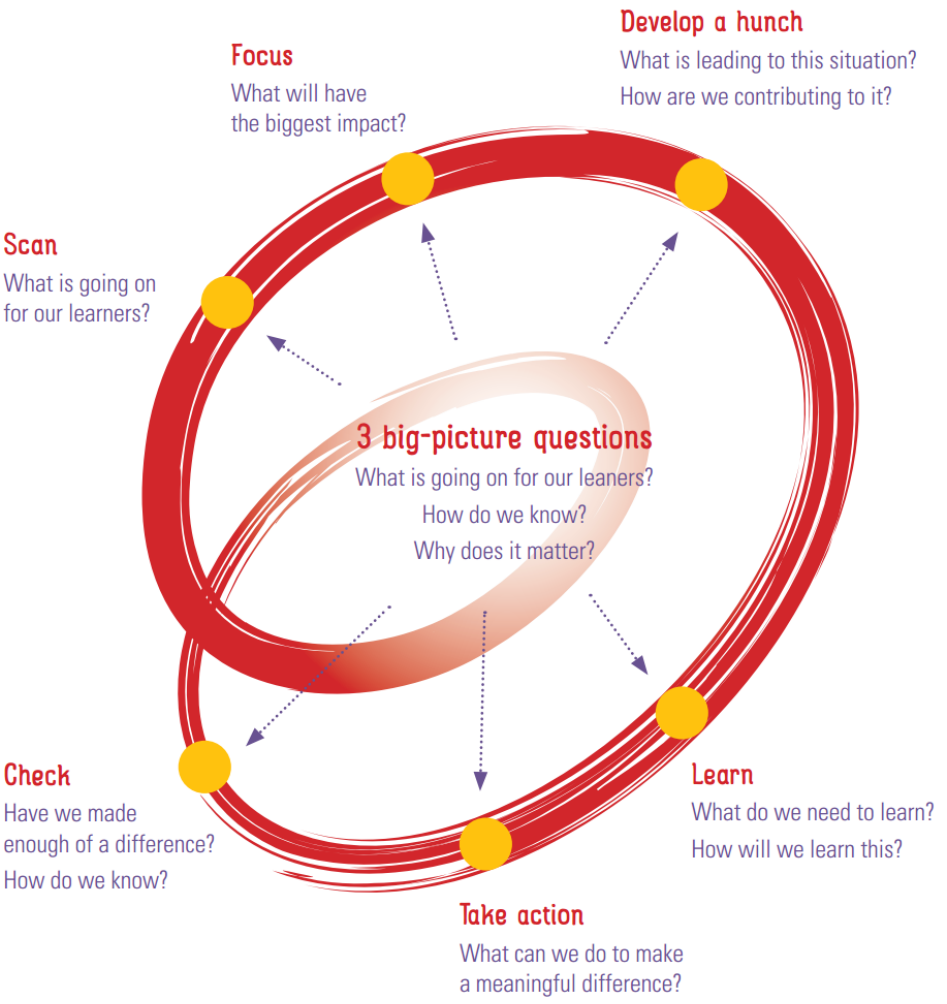


Figure 13. The spiral of inquiry. Adapted from *The Spiral Playbook* by Kaser and Halbert (2017).

Equipment

Teachers were able to purchase equipment using the innovation grant money received upon approval of their projects. In addition, all three schools used their existing computer labs extensively.

Table 3: Summary of the equipment used in the inquiry projects

School	Project	Equipment
S1 Elementary	FreshGrade	3 iPad devices, 3 iPod devices, personal iPhone devices, computer lab (30 desktop computers), & 5 Chromebook
S2 Middle	STEAM and 3D printers	1 Tinkerine 3D printer, 7 rolls of filament, Tinkercad (3D modeling CAD software), class set of Chromebooks (30), & computer lab (30 desktop computers)
S3 Middle	G Suite	iPad, 4 iPod devices, class set of Chromebooks (30), 5 additional Chromebooks, & computer lab (30 desktop computers)

Research Methods

The research with the students and their teachers took place from January 2016 to June 2016. The aim of the innovation grants was to pose and solve problems, and make and test discoveries that arose during the projects. Data collection for this research project was embedded in the regular formative and summative assessment conducted by the classroom teachers. In addition, students were asked to reflect through classroom surveys, discussions, classroom blogs, and teacher interviews on their learning and how they felt the use of technology impacted their learning. Anonymity was provided with any feedback collected and any identifying features were blurred out in the photos shared.

Parents were interviewed informally during parent-teacher interview meetings, after school meetings, and through email. Parents were also invited to complete an informal questionnaire on their thoughts about how their child was learning. S1 asked for feedback from parents on how they felt FreshGrade improved communication of student learning. The students and parents were informed by their teachers about the learning journey the class was taking and that the teachers would be sharing what the class had learned at a year-end meeting with other teachers. In addition, all three school teams, teachers and student representatives, presented their findings to the Board of Education at three separate school board meetings in the evening (Figure 14). Parents and community members were encouraged to attend these presentations.

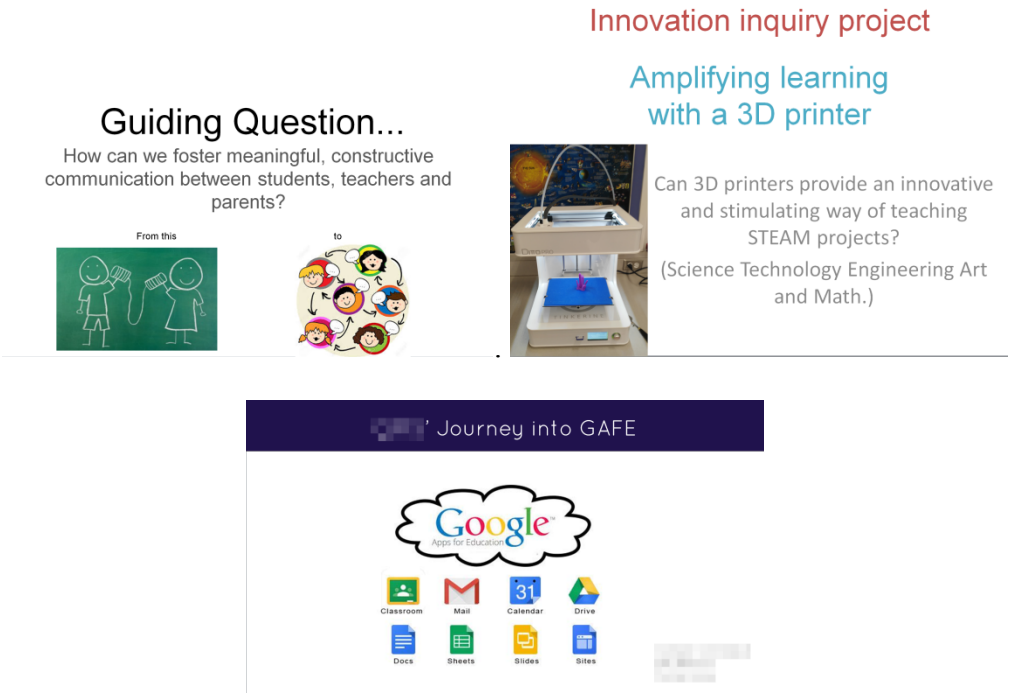


Figure 14. Board presentations. Screen capture of the first slide of each inquiry groups' presentation to the Board of Education.

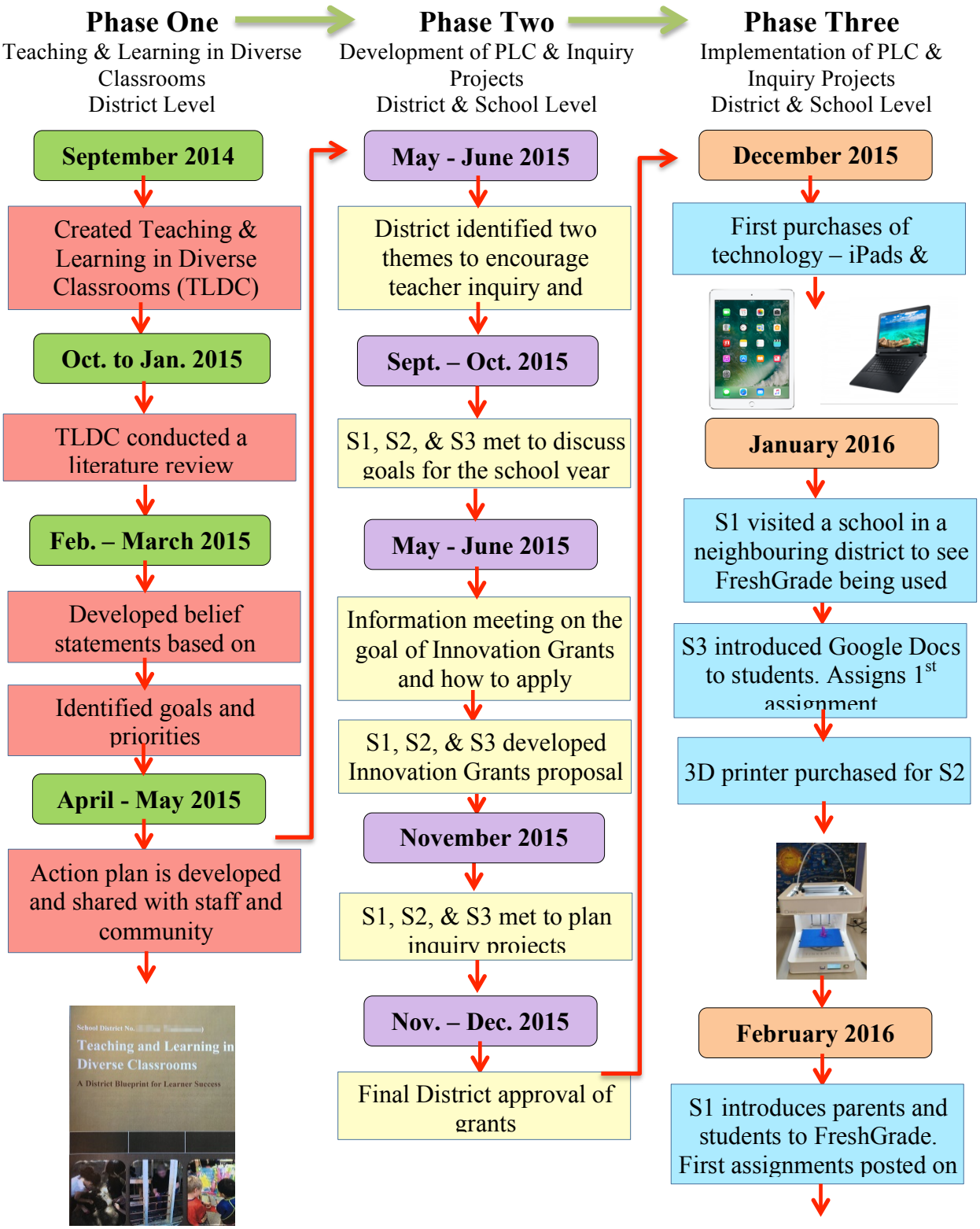
I conducted teacher interviews throughout June and July of 2017 both individually and in groups with teachers. I recorded all our conversations, having asked permission before beginning the interviews. I transcribed the interview notes in August and September. The next step was to

summarize the interview notes, student feedback and quantitative date in a table format. The resulting tables were divided into sections including pros and cons, teacher feedback, student feedback, and parent feedback. Once all three inquiry projects' data were summarized I created a metadata table. I used this metadata table to create themes which I used to outline my findings. (Appendix I: Summary of S1, S2, & S3 Data)

Procedure

The research study was divided into four phases. The first phase, the Teaching and Learning in Diverse Classrooms working group took place from September 2014 to May 2015. The second and third phase, development, implementation, and data analysis took place from May 2015 to June 2016. The final phase, teachers as mentors, began in September 2016 and is planned to continue for the next two to four years.

Timeline (Figure 15)


Phase One
Teaching & Learning in Diverse Classrooms
District Level
Phase Two
Development of PLC & Inquiry Projects
District & School Level
Phase Three
Implementation of PLC & Inquiry Projects
District & School Level
September 2014
Created Teaching & Learning in Diverse Classrooms (TLDC)
Oct. to Jan. 2015
TLDC conducted a literature review
Feb. – March 2015
Developed belief statements based on
Identified goals and priorities
April - May 2015
Action plan is developed and shared with staff and community
Teaching and Learning in Diverse Classrooms
A District Blueprint for Learner Success
May - June 2015
District identified two themes to encourage teacher inquiry and
Sept. – Oct. 2015
S1, S2, & S3 met to discuss goals for the school year
May - June 2015
Information meeting on the goal of Innovation Grants and how to apply
S1, S2, & S3 developed Innovation Grants proposal
November 2015
S1, S2, & S3 met to plan inquiry projects
Nov. – Dec. 2015
Final District approval of grants
December 2015
First purchases of technology – iPads &
January 2016
S1 visited a school in a neighbouring district to see FreshGrade being used
S3 introduced Google Docs to students. Assigns 1st assignment
3D printer purchased for S2
February 2016
S1 introduces parents and students to FreshGrade. First assignments posted on

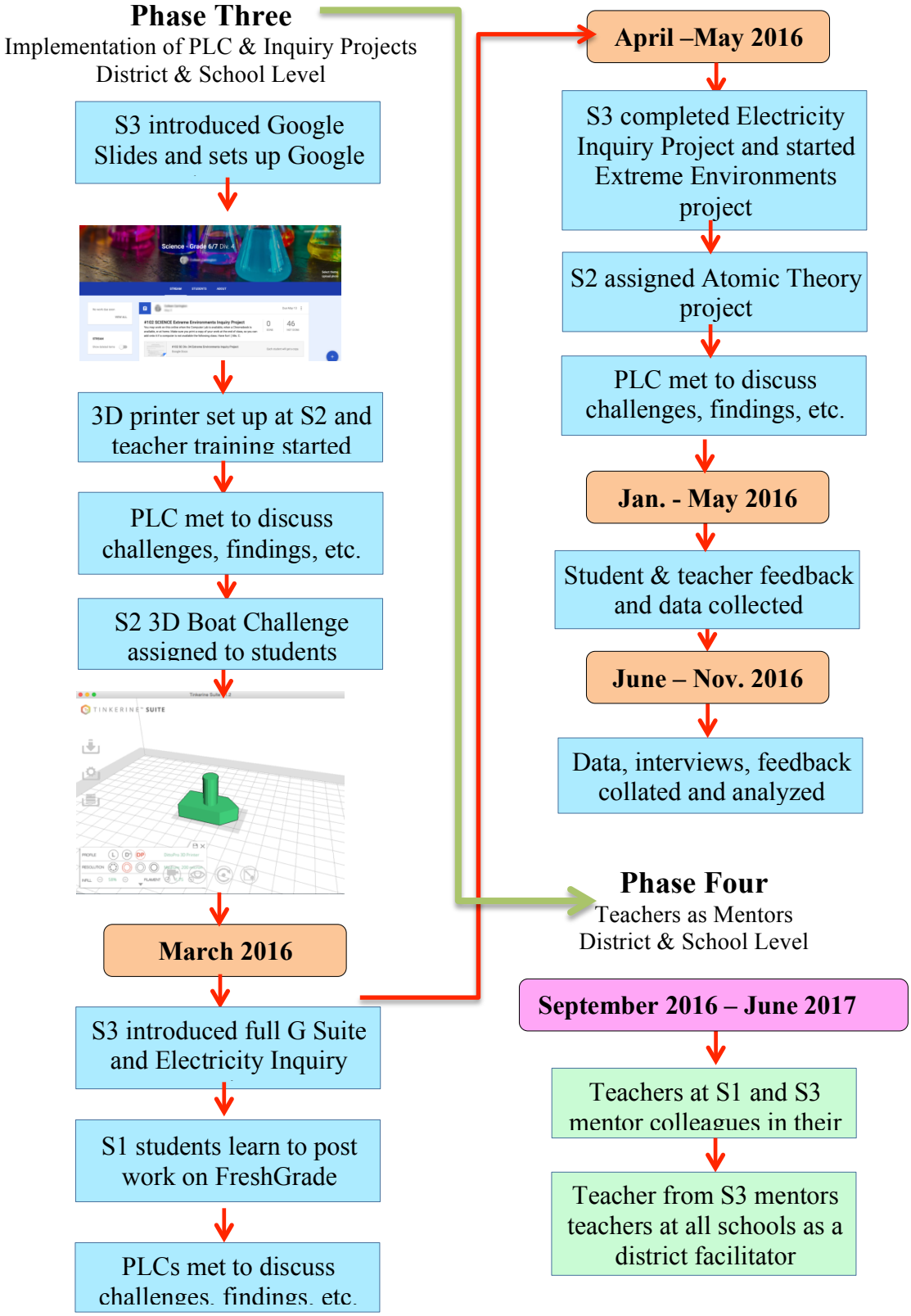


Figure 15. Timeline. Description of four phases.

Curriculum Analysis

Definition of Curriculum

Curriculum is the total experience of an individual under the direction/facilitation of a teacher or school. This definition was developed from my analysis of the curriculum theories of Franklin Bobbitt (1918), Ralph Tyler (1949), and John Dewey (1897) (Figure 16).

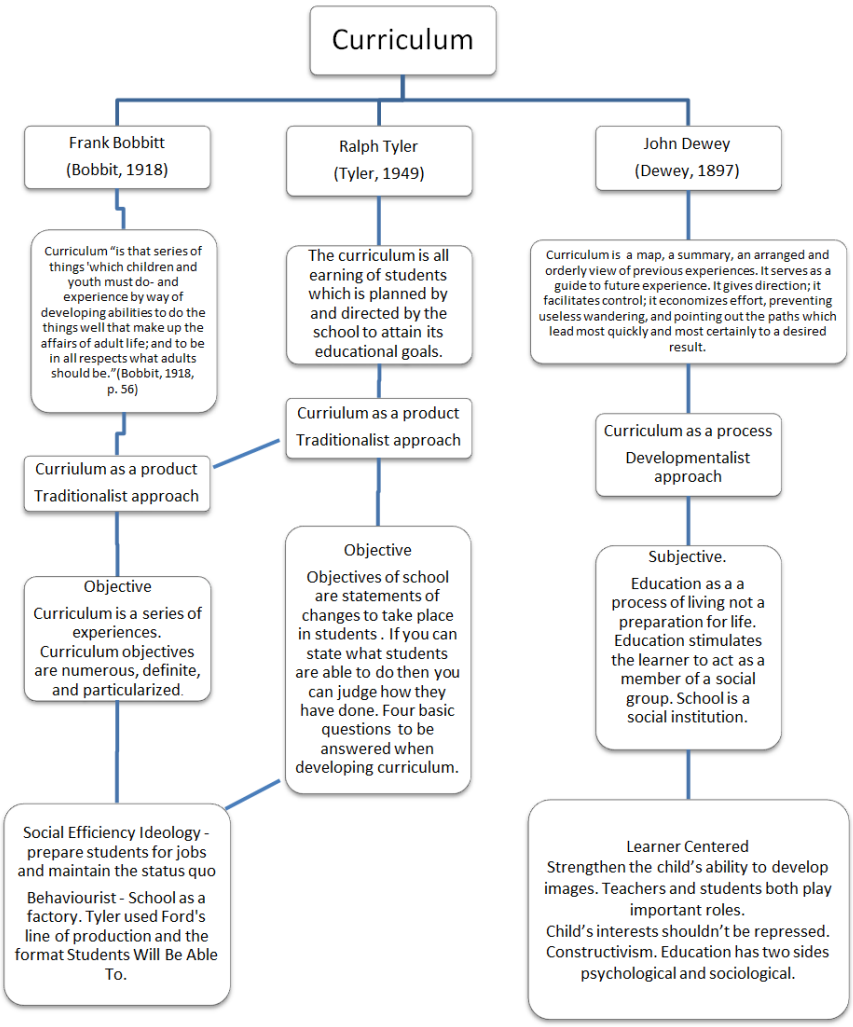


Figure 16: Curriculum. Summary of Bobbit, Tyler, and Dewey's curriculum theories.

There are several underlying assumptions with my definition of curriculum. Curriculum is a process in which the learner's interests, needs and learning patterns are taken into consideration. Curriculum is not a physical thing/container, but rather the interaction of the teacher, student and knowledge. Another key underlying assumption with my definition is that curriculum has two levels of developmental experiences 1) undirected and 2) directed. Education is made up of these two experiences (Bobbit, 1918).

In addition, curriculum is made up three curricula that all schools teach: 1) explicit: the observable, 2) hidden: what is not intended, and 3) null: what is missing. So often what happens in class is unplanned and student led and it is these experiences which become a part of the curriculum. We cannot ignore the hidden curriculum that takes place in the classroom and what often engages students in their learning (Mathison & Ross, 2008).

Furthermore, teachers are seen as facilitators not transmitters of knowledge. The key element is the teacher and the teacher's abilities to balance the needs and interests of the student and the class. According to The Premier's Technology Council (2010), students are taught how to learn not what to learn. There has been a shift from learning information to learning to learn, from data to discovery, from one size fits all to personalized learning and from classroom learning to lifelong learning. In order to make these shifts teachers provide direction and facilitate the learning that takes place in the classroom.

Students are viewed as unique and different and therefore the curriculum that one student experiences will be different than another student. Students are active in inquiry and exploration in order to make meaning out of things. With this definition students would be given the freedom to choose inquiry projects with the guidance of the teacher to help guide their learning and understanding of the topic.

Inclusive Model

When examining the nature of knowledge and how students learn, in order to better guide my research study, I examined the various educational ideologies we had studied during our course work for our Master in Digital Learning and Curriculum. A question that arose for me was, "How do students access curriculum using an inclusive model?" While examining the Learner Centered ideology, during our course work, I had examined my inclusive model of teaching and my strong belief in UDL. Most of the members of the inquiry projects had been members of the UDL Action Team that I facilitated from 2010-2014. Some of the teachers in the inquiry teams discussed what we knew about UDL and we talked about how we would be able to personalize learning as outlined in the revised BC curriculum. According to the BC Ministry of Education Curriculum Overview webpage, "Personalized learning focuses on enhancing student engagement in learning and giving students choices — more of a say in what and how they learn — leading to lifelong, self-directed learning" (2015). This statement helped guide my thinking when I reviewed the goals of the inquiry projects.

A few of us also talked about the concept behind Learner Centered ideology in that the teacher is the facilitator and the student is active in inquiry and exploration to make meaning out of things. In UDL, the teacher tries to plan their units with all learners in mind allowing for multiple means of action and expression, multiple means of representation, and multiple means of engagement. By using these two models, UDL and Learner Centered ideology, all students would be able to access the curriculum.

I knew it was imperative that teachers understood the needs of our students. Students with more significant learning needs had their needs outlined in an Individualized Education Plan or a Personalized Learning Plan. I realized that one of the barriers to all students accessing

the curriculum was time. Time for teachers to understand the needs and interests of students, time to prepare material, time to assess students, time to provide hands-on learning, and time to provide individualized or small group instruction which are all needed in order for students to access the curriculum successfully. Therefore, how could students access curriculum in an inclusive model? One solution was to follow the UDL guidelines. Most of the teachers were adept at planning inquiry projects that ensured students could access content in multiple ways, for example: video, interactive textbooks, Google Docs/Slides, peer reading, e-books, etc. Students were given the opportunity to represent their knowledge in multiple ways, for example: a video blog, spoken word, portfolio, typed assignment either on the computer or with speech to text, or an oral presentation which were uploaded to FreshGrade or G Suite for Education platforms. In addition, by following the big ideas of the redesigned curriculum teachers were able to give students more choice in what and how they can learn.

Another solution to further create an inclusive model was to share resources across school sites. PLCs naturally encourage a climate of sharing. When the teachers met, they were able to share what they had learned in their inquiry projects. Teachers had, in the past, become territorial over lessons and units they had created. Climates of sharing enabled the teachers to better meet the needs of their diverse student population. A climate of teacher collaboration and sharing of resources also helped fill the gap in the BC Redesigned Curriculum which has not fully provided teachers with adequate resources to teach the big ideas and the core competencies.

An inclusive model is not fully addressed in the BC Redesigned Curriculum and providing adaptations and accommodations has become the teacher's responsibility. The school-based PLCs were able to discuss and clarify how personalized learning could help support an inclusive model while implementing the curriculum.

Findings

My research project had two main goals. The first goal was to examine how the use of media and technology can increase student engagement, behaviourally, cognitively, and emotionally. The second goal was to examine how the creation of PLCs or innovation grant teams could be used to support teacher inquiry in incorporating media and technology in their pedagogy. As previously discussed the following three school teams were involved in gathering data to support my findings.

Table 1: Summary of the participants in the inquiry projects

School	Project	Teachers	Students
S1 Elementary	FreshGrade	T1 T2 T3	29 grade 5 students 23 grade 3/4 students 24 grade 3 students
S2 Middle	STEAM and 3D printers	T4	94 Grade 8 French Immersion students
S3 Middle	G Suite	T5	29 grade 6/7 students 27 grade 6/7 students 30 grade 8 students 30 grade 8 students

I chose to present my qualitative findings using a thematic approach in which I combined the findings of the three inquiry projects under five themes: availability of technology, behavioural engagement, cognitive engagement, emotional engagement, and parent engagement.

I will also discuss my findings as to what I found worked and didn't work with the PLC model. I used the key themes of what makes an effective PLC from my literature review: collaboration, shared vision, leadership, and collective focus on students' learning to organize my findings.

Availability of Technology

When the innovation grants were first introduced to the teachers, each team was asked to come up with a list of needs that came within the given budget of $500 to $3,000. Due to the limited amount of money given to each school team, it became readily evident that the teachers would be dependent on the technology that already existed in the school. Most schools in my district maintain a computer lab with 30 desktop computers; however, each class in a school has one or two scheduled blocks in the lab which leaves very few remaining free blocks available for sign up. S2 and S3 also had access to a class set of Chromebooks. All three teams chose to use some of their funds to purchase additional technology to support their inquiry projects. S2 spent most of their budget on the purchase of one 3D printer.

Over the course of the inquiry project, the ease of access to technology increasingly became an issue with all three schools. At first, the students and teachers were minimally using the technology that was available in the schools. By the end of the projects, the popularity of using the computer labs, Chromebooks, iPod and iPad devices, and the 3D printer, meant that students and teachers were not able to get access to complete their projects to the fullest extent. T5 from S3 stated:

> *The biggest problem we found was access to lab time. I created too much demand with 5 classes. The grade 8 classes were fine with their class set of Chromebooks but the three grade 6/7classes were frustrated because they couldn't get access to the lab. We tried to make it work with all three of us pushing at the same time but there wasn't enough lab time available. The more classes that got excited about this the more they were all booking up the lab. We were trying to work in partners and piece it together with the Chromebooks and the iPads.*

T5 noted that her students were excited when they had access to the computer lab and the Chromebooks and frustrated when they did not get enough lab time. As a solution to improving access to technology, the teachers at S3 tried using iPad devices. However, the students found the iPad devices were difficult to use with Google Docs and Google Slides as they did not have access to keyboards and the formatting offered by the apps was more limited on an iPad. The teachers also found the iPad devices difficult to use as each student had individual accounts. This meant that the iPad devices had to be set up for each individual student by deleting the previous student's account every time a student wanted to use the G Suite apps. Students couldn't just log in to an iPad and start working. T5 reported, "The first part of our journey was really complex. We talked to tech support and they released some of the permissions and then the kids could use the apps and devices." The teachers reported that even with the permissions released the iPad devices were limiting.

At S2, the 3D printer was, in the beginning months, usually available when needed. However, over time as the students and teachers became more competent in using the Tinkercad software and as the models needing to be printed became more complicated, access to the 3D printer became more limited. Access to the computer lab had historically been a problem at S2. As a result, the school chose to use their school funds to purchase two Chromebook carts with 30 Chromebooks for each floor of the school.

Access to Wi-Fi was, at first, an issue in all three schools. In the fall of 2016, schools had Wi-Fi for the first time in our district. At first, the Wi-Fi was only available in the library but over the course of the year most of the classrooms were given access to Wi-Fi. However, Wi-Fi access was limited to teacher accounts; therefore, students did not always have the capability to

upload their projects unless their teacher granted the device they were using access. Over time, the issues with Wi-Fi decreased but pockets of inaccessibility did remain.

In summary, all three schools reported that access to technology needed to meet the demands of the students and teachers to complete their projects and upload their work. The technology needed to be fairly distributed among students and classes, portable, and matched to the needs of the projects. In addition, access to Wi-Fi needed to be consistent.

Behavioural Engagement

Time on-task and active participation in class activities were the two main indicators the teachers decided to focus on when assessing behavioural engagement. In S1, the teachers noticed an increase in time on task with their students, especially during the Biennale project. The teachers discussed why the students seemed to be more on task. With further observation, they realized that one of the factors influencing why students were on task was that the students knew that they could be documented at any time. As the teachers walked around the classroom, with the iPod taking photos of the students' work, students were redirected right away knowing that their work could possibly be posted. The Biennale project was engaging in its design and the students were very motivated to have their work posted on the FreshGrade site. T1 and T2 also commented that as FreshGrade was used to clearly communicate the criteria for an assignment to both students and parents, students were more on task as they knew what was expected of them in order to complete the assignment.

In S2, the students were also observed to be more on task. Several students reported they felt more engaged when programming with Tinkercad and when using the 3D printer. They reported it was fun to see the 3D printer print and make things and that the 3D printer made their

class more interactive by creating hands-on experiences. One student decided to stay near the printer for the entire time it took for her boat to be printed. She reported it took 38 minutes for the model to be completed. She was willing to wait as she wanted to see how her boat would turn out so that she could test it out right away. Several students felt the printer was so cool and much more exciting than textbooks. The science teacher also reported that the use of the 3D printer, "created a more engaging, hands-on experience that inspired students to learn."

In S3, T5 tallied the results of her survey question, part b question #2 (Appendix J: Google Apps Student Survey) to help inform our analysis of student engagement. 90% of the students reported that they felt they were more actively involved in their learning. One student said he was more focused in class because he was proud of his work using Google Slides. T5 remarked that there was a higher percent of on-task behaviour. T5 said, "Kids who were normally off task wandering around the classroom were sitting there, fully engaged, trying to figure out how to use G Suite." T5 also felt using Google Classroom increased engagement with their low-level learners as well because "the students loved the technology and they wanted to look good amongst their peers."

Overall, the three schools all reported increased levels of behavioural engagement in the classroom. Students were found to be more on task and active in their learning as evidenced by the enthusiasm they showed when using the various media and technology available in the classroom.

Emotional Engagement

Emotional engagement refers to students' feelings, reactions to others and topics or tasks, and relationships to others (Bundick et al., 2014; Fredericks, Blumenfeld, & Paris, 2014;

Parsons, Nuland, & Parsons, 2014). This definition was used to guide our assessment of emotional engagement in our students throughout the inquiry projects. All three schools reported increased levels of emotional engagement with their students.

In S1, teachers wanted to look at authentic ways to engage their students emotionally. Oftentimes it was felt students were emotionally disengaged. The teachers at S1 discussed how the use of FreshGrade as an e-portfolio could increase student engagement. They felt that the student-centered nature of e-portfolios would facilitate increased student engagement and promote meta-cognition, deeper thinking and foster a sense of success as the students would be able to showcase their growth and development. Once FreshGrade was fully implemented, the teachers reported that students were excited when their work was posted. The students shared that they could not wait to get home to show their parents what they had done. Students were proud to show their parents what they were doing. Several students in T3's class reported how they wanted to share their work with their parents as soon as they went home. Another student reported that she liked it when she was given the iPod to take pictures of her work as she was able to show her mom exactly what was happening in the class.

The goal of the inquiry project at S2 was to stimulate students' interest and motivation, enriching both the curriculum (in Science, Math, and Applied Design, Skills and Technologies) and Core Competencies, especially Creative and Critical Thinking. In reaching these goals the teachers felt they were able to increase the emotional engagement of the students. T4 reported that the students were very excited when they knew they were going to be working on an inquiry project that involved programming with Tinkercad and the use of the 3D printer. When presenting T4`s findings, of the use of the 3D printer, at the School Board of Education meeting, T4 said: "It equipped students for the future. They felt more emotionally invested in the

assignments as they saw the 3D printer as advanced technology. Students said it gave an advantage in our next technological revolution in digital manufacturing." When observing the students programming and setting up the 3D printer to print their boats, students were excited and engaged.

At S3 similar evidence of increased emotional engagement was reported by both teachers and students. The level of excitement and student engagement increased significantly when T5 introduced Google Docs for the first time.

> *I introduced them to Google Docs first using an activity which would show the students the capabilities of the app. I had them write three things they would rather be doing instead of being at school on a class list created in Google Docs. Students were instructed to insert the cursor beside their name. I told them they could start writing and bold their favourite one. I didn't tell them what was going to happen next. The kids could see that they were all writing in the same document and they started shrieking with laughter and writing on each other names and going a little crazy.*

From that initial lesson, the students' excitement for what G Suite for Education could offer in terms of collaboration and improving their work did not wane. Students reported that they loved the fact that they could get together with some of their friends and they could be working at home separately but chatting over the internet. Students appreciated knowing that if they were "stuck" doing their work at home they could go online and get help from people in their class. They also enjoyed the social aspect offered in G Suite and would use Google Hangouts to chat while completing their work.

Several teachers at S3 observed students excited to be learning when using G Suite Apps. They felt the overall level of excitement in the classroom was palpable. The students' body

language, leaning over to see what each other was doing, sitting upright, eyes focused on their work, smiles, laughter and chatter were all evidence of increased engagement in the classroom. T5 reported that the students began to share more often with each other and that there was more face to face interactions taking place in the classroom. T5 said, “By increasing student enjoyment and collaboration and the desire to do their work, students are actually excited about doing their work. Students appeared more interested, confident, and proud of how far they had come.” T5 also reported, “The use of technology just increases engagement with our low-level learners as well because they love the technology and they want to look good amongst their peers.

Cognitive Engagement

As mentioned in the literature review section of this paper, cognitive engagement is defined as involving a "psychological investment in learning and mastery of academic material; desire for challenge; enacting metacognitive strategies such as planning, monitoring, and evaluating one’s thinking; and self-regulation" (Bundick et al., 2014, p. 3). The teachers looked for evidence of increased cognitive engagement in students who continued a discussion after school and at home, who did further research and brought to class what they have learned, who were able to self-regulate by staying on task and ignoring distractions, and who completed their assignments while meeting expectations.

As FreshGrade is used as a tool to track student achievement, the teachers at S1 were confident in reporting that they felt the introduction of FreshGrade increased students’ cognitive engagement. The teachers in the intermediate grades reported an increase in completed assignments and an increase in test scores. They attributed this increase in achievement due to

study links being available online such as a link to a YouTube video on symmetry as seen in Figure 17.

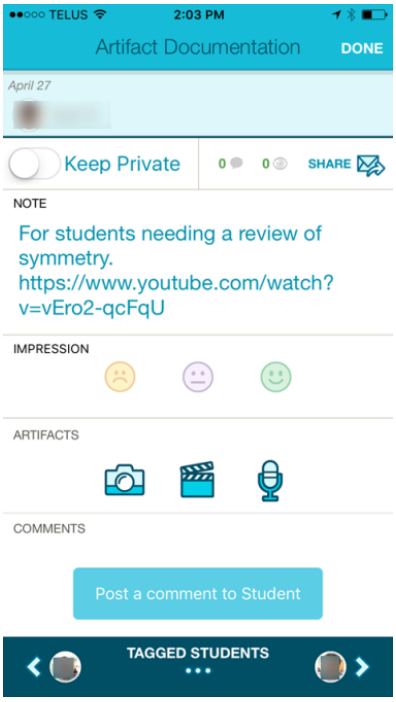


Figure 17: Review of symmetry. Sample of a video link for students needing a review of symmetry.

The teachers also posted student's grades on each student`s individual e-portfolio this allowed the students the opportunity to see what areas they needed to improve on. The teachers found that by using the Gradebook section of FreshGrade the students became more accountable for their grades (Figure 18).

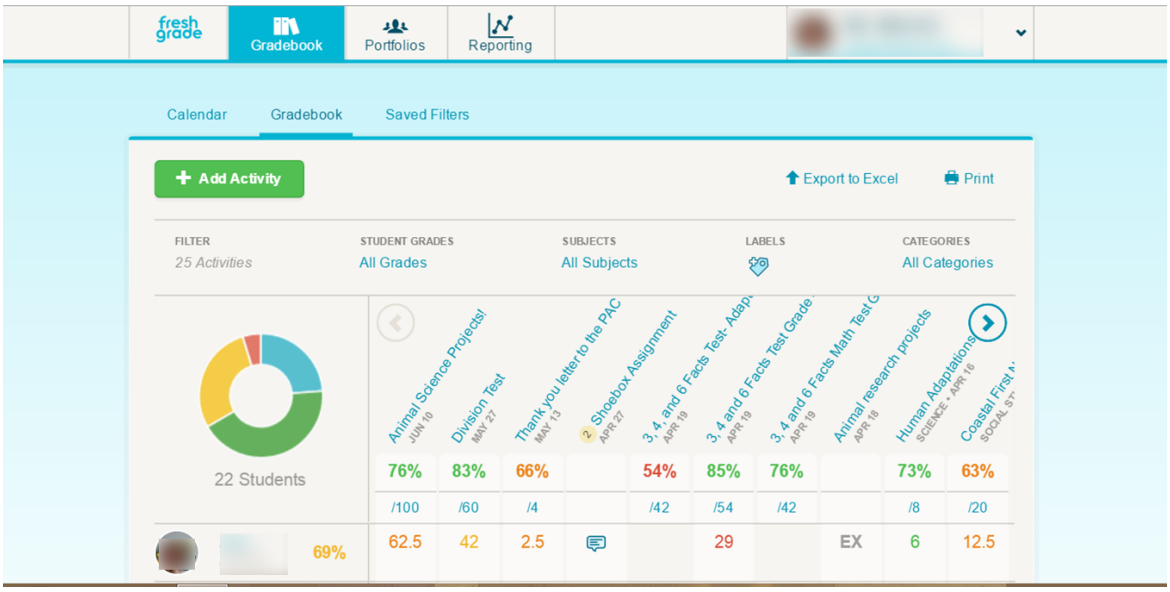


Figure 18: Gradebook. A sample of a student`s grades.

T1 reported that "Everyone, including parents, had the criteria for an assignment; therefore, everyone knew the topic, the task and the due date. As a result, students understood what was expected of them and they became more invested in learning and mastering the content." (Figure 19 and 20).

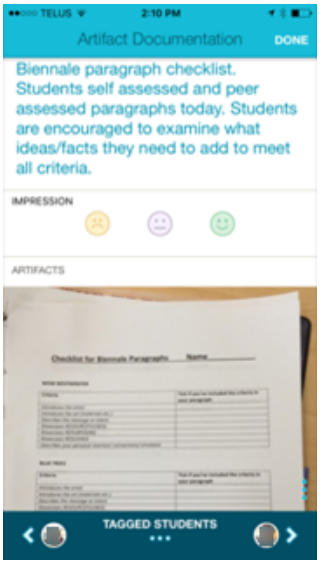


Figure 19. Biennale checklist. An example of posted criteria for an assignment.

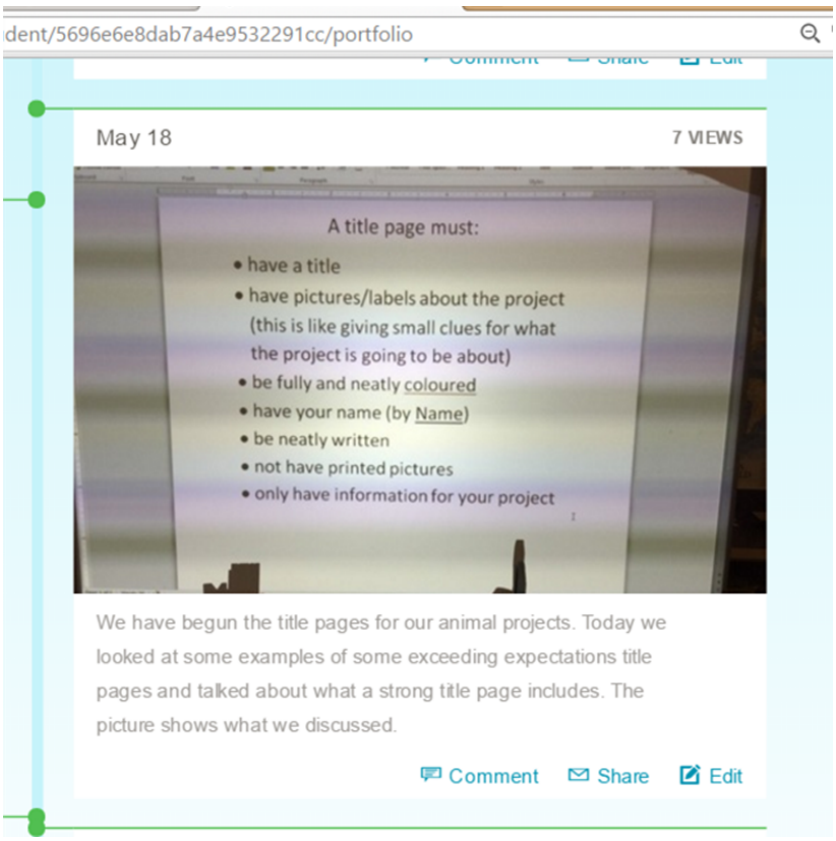


Figure 20. Title page criteria. Criteria for a strong title page.

T3 felt that FreshGrade allowed parents to better understand their teaching style and the learning that happened in the classroom which meant that the parents could better support their children at home.

Several students reported that they studied more for tests because they knew their parents would see their grades. Some students also said they wanted to learn more so that they could show their parents what they knew. Several students in all three grades reported that they would go home and try to teach parents what they had learned that day by showing their FreshGrade portfolio. Students were also given the opportunity to post their marked tests on FreshGrade in order to share the results with their parents. Oftentimes, students would correct their work and try to complete the bonus questions at home (Figure 21).

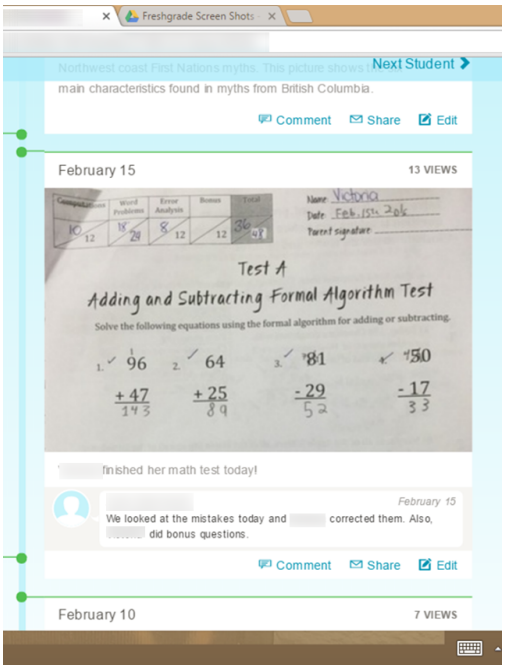


Figure 21. Corrected math questions. Evidence of student's effort to improve their understanding of the math concepts.

The teachers confided that they felt they had met their goal of increase cognitive engagement by "110%".

In S2, one of the goals of their inquiry project was to challenge and motivate students to think creatively as they designed and built scientific models. T4 reported that the 3D printer helped students to develop their imagination and visualization skills. T4 observed that students, who, in previous years, had difficulty grasping concepts such as density and the structure of atoms, were able to explain the concepts with the used of the 3D models they had created as visual aids. Students were challenged to think creatively to design their digital models using 3D CAD programs and to then build their designs. T4 reported that the use of the 3D printer improved problem-solving skills with the use of prototypes to evaluate and improve the initial plan when trying to solve the challenges. Several students found that it was easy to design and

test prototypes and that once they could see the model of the atoms they could better understand what they were learning (Figure 22).

Figure 22. Customizable atom deluxe. 3D model of an atom created by a student.

T4 reported that the 3D printer created hands-on experience which deepened students' understanding. T4 stated, "It was not mandatory, but almost everyone tried and worked after school to finish their experiments and calculations" (Figure 23).

Figure 23. Students and the 3D printer. Watching their models being printed.

Further evidence that the use of the 3D printer improved cognitive engagement at S2 was the creation of the 3D printer club. Students began to conduct self-directed inquiry projects. The students in the club completed self-directed inquiry projects on a variety of topics that were of interest to them.

In S3, the level of enthusiasm for the use of G Suite for Education became infectious. As the students became more excited about the opportunity to show their work in a different way, they also asked to be able to collaborate more on assignments. Teachers reported that many of their students' marks began to go up, that the work that was completed was a better finished product, and that the students took ownership for their individual projects and also ownership for their part in group projects. No longer were students reluctant to do group projects or complaining about people in their groups not doing their share of the work. The teachers also reported that the several students were creating more in depth projects and that the internet allowed the students to go beyond the scope of what the books in the library could offer. T5 reported, "The kids developed a deep level of knowledge because they would pose their own questions and they would look for higher level materials to impress everyone with their knowledge."

There was also evidence of increased student engagement as shown in the increase in students asking to do self-directed inquiry projects. One student asked to if she could do a self-directed project on platypus and when the other students saw she had done they also began to ask if they could do their own projects (Figure 24).

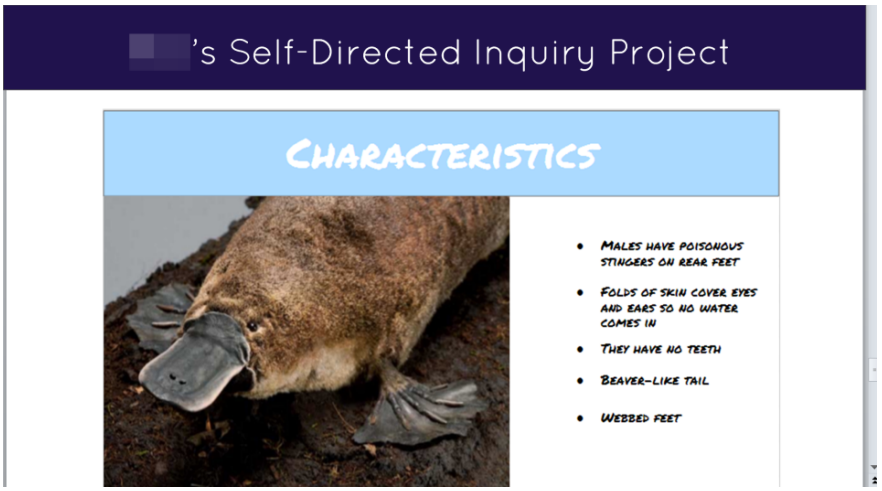


Figure 24. Self-directed inquiry project. Slide from a student's inquiry project.

T5 stated, "I had at least a half a dozen kids asking to do extra work in their own time. They were doing all these inquiry/research projects because they had the tools. It also built a stronger sense of community in the projects. Cognitively – they could challenge themselves."

Several students shared that the teacher's and their peers' comments in Google Classroom helped them to improve their project. A few students also reported that they started to do more homework at home because they wanted to learn more things and they wanted to show their friends what they knew. The teachers felt the level of cognitive engagement increased with the introduction of G Suite for Education at S3 in a significant way.

Parent Engagement

Increasing parent engagement was a main goal for S1. The teachers hoped that the use of e-portfolios would be a way to increase parents' involvement in their child's learning. They envisioned that FreshGrade would give parents a window into the teachers' classrooms by providing opportunities to engage with their child's progress in a timely manner. E-portfolios

would also allow communication to be increasingly frequent, informative (e.g., showing rubrics/ ministry standards) and personalized (e.g., photos, video, student self- reflections).

Evidence of parent engagement was shown in the numbers of views of the FreshGrade posts. During the month of May and the first week of June, the teachers counted how many views their posts were getting. The view count for selected posts were 28, 20, 36, 25, 28, 43, and 36 which averaged out to an average of 31 views (Figure 25).

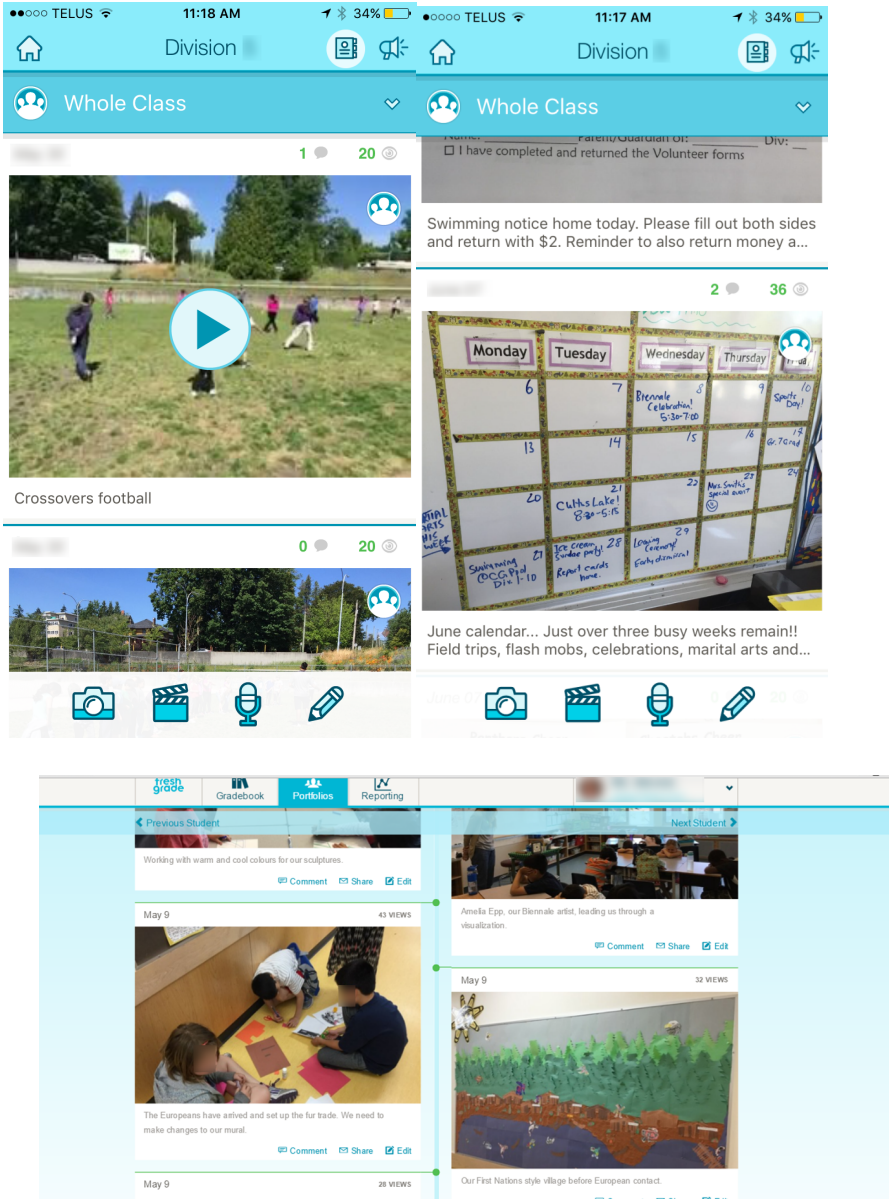


Figure 25. Samples of FreshGrade views. Views of 20, 36, 43 and 32.

When interviewed about how parents felt FreshGrade impacted their family and their child, there was an overwhelming positive response. Most of the feedback received was verbal during parent teacher interviews and during informal meetings. Some parents did provide written feedback. Parents felt that FreshGrade improved their engagement with their child for the following reasons:

- Children who had multiple homes/parents could engage with both parents using the FreshGrade platform;
- Parents had a new voice which was a catalyst for more meaningful conversations at home and less "What did you do at school?" or "Nothing";
- Parents knew what kind of questions to ask their children which resulted in more dialogue;
- There was more awareness of what is happening and the teachers no longer had questions such as "How is my child doing?";
- Parents felt like they were being a part of what was going on in the classroom and were more involved in school work;
- FreshGrade offered the opportunity to provide support and help enrich learning;
- The parents appreciated the ease of access to notices and the ability to connect daily to school work.

Most parents saw FreshGrade as a virtual classroom program with regular updates. Some of the written comments provided supported the above findings. Comments such as:

- *I found FreshGrade easy to access. The notification by email was good and even if there were several email notifications the same day, you just had to go to FreshGrade once to see all that was being reported. It definitely helped at home as we had a good reference point for evening conversations. We were much more aware of what was going on in the*

classroom almost daily. This was due to your diligence in posting so regularly. It was fun to see the class in action and we appreciated the extra effort you made to post individual efforts by students. I feel it is a worthwhile program that makes student progress easier for families to understand. I appreciated your guidelines for family response. This part was more difficult for me personally but it did get easier.

- *I...love, love FreshGrade!!*
- *I like how easy it is. I love how I can see child's name 'in action' at school. I really love the special time we have at home when we check daily for updates. The conversations him and I have are fantastic. I know so much more about what he is learning. It's great. This is a great tool for them (students) as well as us (parents. I really hope the program continues.*
- *Thanks for keeping us connected to our kids and their learning!*
- *"... Lastly, given that our son's birth mom lives in another country we have been able to share some of the pictures and assessments with her to keep her more informed as well. In a world with many different family constructions, fresh grade (sic) helps with communication and support for the child.*
- *This is amazing! It has helped us stimulate conversations at home, have so much more awareness of what is happening at school, and helped us become more involved in child's name's schoolwork. Every day we ask him how school was and what he did. The usual answer is "fine" or "nothing much". We now have the opportunity to provide him with support and help enrich his learning has (sic) increased so much with this app. It has taken a year to really fully understand the impact and to get used to it on my end. Now, if we don't have it next year, we are going to feel so in the dark!*

Showing that FreshGrade improved parent engagement was a key criteria for S1's inquiry project and the parents' comments and feedback showed that the parents definitely felt more engaged with their child's learning. Increasing parent engagement at S2 was not a key focus of the school team's inquiry projects. However, a few parents did share with T4 their child had shared with them what they were learning in school and shared what they had learned using the 3D printer. S3 had similar positive feedback from parents to S1. Some parents reported the following during parent teacher interviews when the students were given the opportunity to show them Google Classroom:

- *I enjoyed being able to see what my son had learned that week. When we asked him what did he learn we never got a clear answer from him.*
- *My daughter could not wait until we got home to show us what had been posted on Google Classroom. We enjoyed learning about what she was doing in class.*
- *I work shift work and am not often home when my son comes home from school. Google Classroom let me see what he was doing and I could talk about it with him on the weekend. We could see when he was completing all his work.*

T5 reported that the overall feedback was that the parents were impressed with the work the students were producing. Students were better able to show their parents what they were learning in class which then generated better discussions at home. In summary, the level of parent engagement increased in both S1 and S3 through the use of FreshGrade and Google Classroom as a communication tool between the school and home.

Professional Learning Communities

The second goal in my research project was to examine how the creation of PLCs could be used to support teacher inquiry in incorporating media and technology in their pedagogy. As

summarized by Clarke, “The four ideas of collaboration, shared vision, leadership, and collective focus on students learning were identified as common themes” that were needed for a successful PLC (2014, p. 31).

Collaboration

The innovation grants application stated “Inquiry/action research is based on the belief that understanding is constructed in the process of people working and conversing together as they pose and solve problems, and make and test discoveries that arise in the course of the shared activity” (Appendix A: Innovation Grants 2015-2016). Using the premise that inquiry requires people working and conversing together helped set the stage for a collaborative approach for our PLCs. In S1, T1, T2, and T3 already had a history of working together and collaborating. Applying for an innovation grant was a natural next step for the teachers. The teachers had a common lunch and all three had student teachers which allowed them to meet on a regular basis to plan and reflect on their inquiry project. The three teachers also team taught and had buddy classes.

In S2, the opportunities to collaborate were built into the timetable. The teachers had three shared 45 minute preparation blocks which gave them the opportunity to collaborate and plan how they would use the 3D printer to promote the cross-curricular approach of STEAM. The science teacher, math teacher, and technology education teacher met when they needed to plan and reflect on their inquiry project goals.

The collaborative climate that already existed in S3 also made for a natural next step for the team at S3 to apply for an innovation grant. During my interviews with the T5, I asked her what they she was the most important factor to have a successive collaborative PLC model. She stated that the most important factor was that the teachers had to be based at the same school.

She felt that it was important that teachers had the opportunity have both planned and impromptu meetings. Collaboration at impromptu times such as during lunch time allowed for ongoing troubleshooting and problem solving.

In summary, the key components that were needed in order to have a successful collaborative model were: shared preparation blocks, shared lunch, opportunities for impromptu meetings, people working together and conversing in planned meetings, and teams that were school based.

Shared Vision

A shared vision needs to be meaningful and guide an organization's purpose. It must be developed with the stakeholders and not be created in isolation by administration. The vision of the innovation grants was to offer learning experiences to our youth that ignite their creativity and engage them in their own learning and to harness the digital tools of today's world to provide higher quality learning experiences and opportunities for our children (C21 Canada, 2015, p. 3). In addition, I believed technology provides the opportunity to enhance learning and engagement and that all students should have an opportunity to access the curriculum using an inclusive model. However, due to several limitations it was difficult to discuss and come up with a shared vision in which I played a role.

Leadership

The role of the administrator is a key element in effective PLCs. In order for educational change to take place through PLCs it is important to have an involved administrator who can provide guidance and support. While my goal was to provide leadership to each school PLC, the

reality became something different. Due to time constraints and a change in my role at the district level I was not able to provide the leadership that I had envisioned. What transpired instead was that the more experienced teachers (school champions) provided mentorship and leadership to the teachers who were learning.

Throughout the inquiry projects it was evident that I needed to better develop a relationship with my three school teams which involved time that I did not have. Trust to share, learn and try new things were developed at S1 and S2 through the school champions which enabled them to provide leadership either through suggestions based on their own experiences or through a collaborative journey of discovery.

Collective Focus on Students' Learning

Finally, the last theme that made for a successful PLC was the need to have a collective focus on students' learning. The focus on students' learning was threefold: a) promote meta-cognition, deeper thinking and foster a sense of success as the students would be able to showcase their growth and development (S1), b) stimulate students' interest and motivation, enriching both the curriculum (in Science, Math and Applied Design, Skills and Technologies) and Core Competencies, especially Creative and Critical Thinking (S2), and c) to use the online tools, G Suite Apps for Education to allow students to work collaboratively (S3). A requirement for receiving the innovation grants was to provide, at the end of the year, evidence based data that would show the success or failure of the inquiry projects. The teachers had to demonstrate at the end of the year how the students' learning improved. The teachers met to discuss what evidence they would gather to inform their success and failures. They chose to gather evidence such as time on task, evidence of student interest in tasks through student feedback, teacher

observation, surveys, test results, and grades. They also discussed what resources they would use to guide their practice. Once they had decided what evidence they were going to gather they returned to our collective focus on students' learning to reflect and revise. Without the collective focus which was outlined right at the beginning of their inquiry projects the teachers would not have had clear guidelines as to what evidence they wanted to collect.

In conclusion, this section reported findings, which were mainly qualitative in nature that demonstrated that the three inquiry projects were able to show how the use of media and technology could increase student engagement, behaviourally, cognitively, and emotionally. The findings also informed the second goal of using PLC to support teacher inquiry in incorporating media and technology in their pedagogy. The findings showed that the role of a PLC helped support teacher inquiry in incorporating media and technology. The PLC model was modified from the original vision of a district led PLC to more of one which involved teachers in innovation teams supporting one another. The teachers in the inquiry project reported that without the support of their colleagues they would not have explored the use of media and technology to the extent that they did. The next section will discuss the limitations and future considerations of this research project.

Future Considerations, Limitations, and Conclusion

When interviewing the teachers in the inquiry projects we reflected on what worked and what didn't work. We discussed some of the barriers and future considerations such as: availability of technology; the need for a teacher champion; addressing the technology competency of parents, students, and teachers; and other factors. I also reflected on what were the limitations and future considerations of an effective PLC.

Availability of Technology

Some of the limitations pertaining to the availability of technology were discussed in the findings section of this paper. Limitations such as access to lab time, equitable access to Chromebooks, missing devices, lack of Wi-Fi access for students were all concerns that were raised. All three schools expressed frustration with the lack of access to the computer labs. The available free space in the school labs was very limited which created frustration for the students and the teachers.

Various solutions were tried to improve student access to either the computer lab or to the Chromebooks. At S1, the teachers tried booking the computer lab as often as they could. They combined the classes and had students work in partners. This was met with limited success. S2 had access to Chromebooks but they found the number of Chromebooks was not enough to meet the demands of the students. In S3, the teachers encouraged the students to work in partners while using Chromebooks and the iPad devices to ease the demand. This solution was workable but it was not ideal as students were not always working on group projects. For the following year, phase four, of this research study, both S1 and S3 are introducing the use of their chosen media and technology at a slower pace. All three schools are investing more of their school

budgets, especially with the recent funds given to schools from the Ministry of Education through the School Enhancement Program, to purchase additional Chromebooks and carts for the 2017-2018 school year.

Another limitation was access to devices to document student learning at S1. Until the iPod devices were ordered at S1, the teachers often used their personal devices to document student learning. In addition, when the teachers and students were using school owned devices the teachers would loan the device to a student or another teacher and would sometimes forget to get the device back. One solution, that is being explored, is to buy devices for the resource teachers, music teachers, and the librarian so that they can also document student learning without using the classroom iPod.

What we learned about availability of technology is that teachers need to consider if the school can provide equitable access to media and technology. The teachers feel that it is important to gauge how quickly one introduces the apps from G Suite or all the features of FreshGrade.

Teacher Champion

The need for one or more teacher champion(s) in each school was a common theme across all three schools. The teachers stated that there needed to be someone on staff who provided knowledge, leadership, motivation, and organization to the team and their colleagues. They felt that if there was not a teacher on staff who was the champion/mentor in the use of media and technology then teachers would be less inclined to explore the implementation of media and technology in their pedagogy. Therefore, in the 2017-2018 school year, the teachers are all mentoring their colleagues in various capacities. In S1, the three teachers are mentors to

four additional teachers in their school. In S2, the teacher who led the inquiry project has become the district technology facilitator. She mentors many teachers throughout the district. In S3, T5 has become a mentor for more teachers in her school.

One of the benefits of having a teacher champion in each school is that it allows teachers to have those classroom visits, impromptu meetings, lunch time discussions, ongoing dialogues, staff meeting discussions and all the other natural networking that happens in a school on a daily basis. Having a teacher champion in each school helps support the goal of increasing teacher capacity in the use of media and technology as identified in our TLDC research. Ideally, a teacher champion would be given release time to support their colleagues. Scheduled release time would ensure that the teacher would not experience burn out by having to be both a media and technology champion and a classroom teacher.

Technology Competency

The competency level with the use of media and technology differed from school to school and from person to person. Factors such as the learning curve and pace of implementation of the media and technology, the limiting time of one year grants, limited competency of some students, the need to teach what is a digitally responsible citizen, and empowering parents all played a role in our findings.

The innovation grants required teachers to research and learn about the media and technology they would be using. In both S1 and S3 some of the grant money was used for release time to observe another teacher using FreshGrade. This gave teachers the opportunity to improve their level of competency in using the FreshGrade platform. The innovation grants also required teachers to work in teams of no less than three people. This requirement meant that teachers

could support one another in their PLCs to explore, research, and learn. PLCs enable teachers to develop new skills and to feel supported when trying those new skills. What resulted was the level of competency amongst the teachers rose over the duration of the inquiry projects. However, two of the first-year teachers at S3 found the learning curve to be quite steep and were overwhelmed with learning how to use G Suite and having to manage the workload that comes with being a first year teacher.

The teachers felt that having one year to complete the inquiry project was not enough time. T1, T2, T3, and T5 are continuing their inquiry projects in the fourth phase. T4 is not able to continue due to her change in position from school-based to district-based.

In S1, the teachers reported that the competency requirements for FreshGrade were not demanding; but they did report there was a learning curve in how best to use the platform. They would recommend that schools should commit to, at minimum two years, to get the most out of what is available from the platform. The second year is enabling the teachers to further develop their level of competency with the FreshGrade and with G Suite.

At S1 and S3, the teachers identified the need to develop students' level of competency with FreshGrade and G Suite. At S1, the teachers posted samples of students' work, classroom events, notices etc. In phase four, the teachers are teaching students how to post their work on FreshGrade using the classroom iPad devices and Chromebooks. In addition, the childcare worker and librarian have access to the FreshGrade accounts this year and are posting to individual and classroom accounts.

In S3, T5 commented that not all the group managers (students) were technologically capable enough to post and use the G Suite apps. Time needed to be devoted to teaching students how to upload their projects. This year, more time is being devoted to teaching students how to

use G Suite. In addition, the teacher at the S3 realized that even if and when the students began posting in G Suite they did not have enough knowledge about what it meant to be a digitally responsible citizen. Although the students had signed the District Student Technology Agreement form (Appendix E: District Student Technology Agreement), they did not fully understand what they had agreed to. In phase four, T5 is teaching the students what it means to be a digitally responsible citizen. The teacher developed a jigsaw activity which had students choose one aspect of the user agreement and demonstrate their understanding of the activity in a Google Slides or poster format (Appendix K: Technology User Agreement - Group Jigsaw Activity). This activity was done early in phase four. In future years, T5 plans to have students complete this activity at the beginning of each school year.

The teachers at S1 found, through the feedback provided through parent surveys, that some parents were not comfortable with using FreshGrade. Several parents commented that they wanted to comment in FreshGrade, but were unsure of what to write or how to write a constructive comment. There were also approximately three to four parents in each class who accessed FreshGrade less than five times throughout the year. When asked what they identified as the barriers some parents reported that some aspects of the interface were not intuitive and that they felt they would have benefitted from learning how to respond appropriately. It was evident parents were using FreshGrade as the teachers could see the number of parents who were on; however, the parents did not always comment. Verbal feedback was given and emails were sent.

The teachers at S1 said they would begin the 2017-2018 year with a FreshGrade introduction night. They would walk parents through the platform, show them the basics, and discuss their expectations for themselves, the students and the parents. During the evening the teachers would also collect email addresses and have parents sign the permission forms. They

hoped this would get parents on board right away instead of having to chase them down. The teachers are also planning to make Chromebooks available to parents to check in to FreshGrade when waiting to pick up their child. A FreshGrade station at the library is also going to be available for parents to use. By improving parents' comfort with how to use FreshGrade and by making Chromebooks available for parents to access their child's account it is hoped that parent engagement will increase.

In summary, the teachers would recommend to other teachers considering implementing any media and technology the need to have a well thought out plan that involves the consideration of the following aspects:

1. Equitable access to media and technology;
2. Introduce the media and technology in a slow paced with well thought out lessons that involve all students and parents if needed;
3. Ensure there is a school-based teacher champion who can mentor and support teachers;
4. Incorporate lessons that teach and support students' competency in using the media and technology.

Professional Learning Communities

The use of a PLC to support the teachers in their inquiry projects was not fully implemented as planned. The goal for me to provide leadership to the individual innovation grant teams did not happen to the extent I hoped. During the second and third phase of this research project my role changed at the district level from District Vice-Principal to District Administrator. This role change meant that my responsibilities and work load changed significantly and I was not able participate at the school level as much as I would have like to.

Upon reflection, in order to provide the administrative leadership that is needed for a fully successful PLC, I would recommend the administrator needs to be either school based or needs to have the necessary time and resources to support individual school teams. The innovation grant teams acted as PLCs in that they had a shared vision, leadership through a teacher champion, were collaborative and had a collective focus on student learning.

Conclusion

From my research findings, it can be identified that student engagement, behaviourally, cognitively, and emotionally, can be improved through the use of media and technology and with the correct supports in place. In my review of the findings from my research project, there are many factors that affect student engagement. Equitable and adequate access to technology; a teacher champion who can support their colleagues, students, and parents; opportunities to go beyond the expectations of the assignment or to complete individual inquiry projects; opportunities to collaborate; increased understanding of expectations/criteria; and increased opportunities to be critical thinkers and problems solvers were all factors that increased student engagement through the use of media and technology. We want caring, compassionate and nurturing learning environments where students are encouraged to explore, learn, and collaborate. We want teachers to also feel that they can teach in an environment that encourages them to explore, learn, and collaborate.

Therefore, it was important to increase teacher engagement by creating PLCs facilitated by an administrator that would allow teachers to deepen their understanding of not only student learning but also of their own learning. By empowering teachers to try new technology and by encouraging a culture of risk-taking we will be better prepared to teach our students. Teachers do

not need know everything about technology; but they need to stay committed to learning. By involving students in that learning and by encouraging students to be collaborators and leaders in the use of media and technology we will further increase student engagement.

Further research needs to be done on teacher use of media and technology to show a correlation between the use of media and technology and student learning and achievement. Increasing the access to ICT in schools has not shown to result in significant improvements in student learning in reading, writing, and mathematics (OECD, 2015). Therefore, it is important to also look at how ICT is implemented in the curriculum and what kinds of supports are provided.

A strength-based approach, where we focus on the skills and talents of our teachers and students, is one of the keys to being able to successfully implement media and technology in our pedagogy and to have an effective PLC. Teachers and administrators who are passionate, motivated, and able to create and cultivate positive relationships are in the best position to engage and empower our students. PLCs that are supported by administrators who help teachers develop a shared vision and time to collaborate will ensure the success of the PLCs and of the students in their schools.

References

Alexander, C. (2014). Student-created digital media and engagement in middle school history. *Computers in the Schools, 31*(3), 154-172.

Arntzen, J., Krug, D. & Wen, Z. (2008). ICT literacies and the curricular conundrum of calling all complex digital technologies "Tools". *International Journal of Education and Development Using information and Communication Technology, 4*(4).

Babione, C. (2015). *Practitioner teacher inquiry and research*. San Francisco, CA: Jossey-Bass.

Banitt, J., Theis, S., & Van Leeuwe, L. (2013). The effects of technology integration on student engagement (action research project). St. Paul, MN: St. Catherine University.

Barack Obama. (n.d.). BrainyQuote.com. Retrieved January 5, 2017, from BrainyQuote.com. Retrieved online: https://www.brainyquote.com/quotes/quotes/b/barackobam409128.html

BC Ministry of Education. (2015). BC's New Curriculum. Retrieved online: https://curriculum.gov.bc.ca/

BC Ministry of Education. (2017). Foundation skills assessment. Retrieved online: http://www2.gov.bc.ca/gov/content/education-training/administration/kindergarten-to-grade-12/assessment/foundation-skills-assessment

Boss, S. (2001). Leading from within. *Northwest Teacher, 2*(2), 12-16.

Bobbitt, F. (1918). *The curriculum*. Boston: Houghton Mifflin Company

Bundick, M. J., Quaglia, R. J., Corso, M. J., & Haywood, D. E. (2014). Promoting student engagement in the classroom. *Teachers College Record, 116*(4)

C21 Canada. (2015). *Shifting minds: A 21st century vision of public education for Canada*. Retrieved online: http://www.c21canada.org/.

Clarke, K. C. (2014). The identification of successes and barriers in establishing professional learning communities from principals' perspectives. Mankato, MN: Minnesota State University. Retrieved online from: http://cornerstone.lib.mnsu.edu/cgi/viewcontent.cgi?article=1340&context=etds

Clark, R. (1994). Media and method. *Educational technology research and development, 42*(3), 7-10. Retrieved online: http://www.jstor.org.ezproxy.library.ubc.ca/stable/30220073

Cooper, D. (2007). Talk about assessment: Strategies and tools to improve learning. Toronto: Nelson Education.

Couros, G. (2015). *The innovator's mindset: Empower learning, unleash talent, and lead a culture of creativity*. San Diego, CA: Dave Burgess Consulting.

Dewey, J. (1897). My pedagogic creed. *School Journal, 54*, pp. 77-80

Dewey, J. (1929). *The sources of a science of education*. New York, NY: Horace Liveright.

Downes, J., & Bishop, P. (2012). Educators engage digital natives and learn from their experiences with technology: Integrating technology engages students in their

learning. *Middle School Journal, 43*(5), 6-15. Retrieved from http://www.jstor.org.ezproxy.library.ubc.ca/stable/23119436

DuFour, R., Eaker, R. E., & National Educational Service (U.S.). (1999). *Professional learning communities at work: Best practices for enhancing student achievement*. Bloomington, IN: National Educational Service.

Engage. (2017). In *Oxford English dictionary*. Retrieved online: http://www.oed.com.ezproxy.library.ubc.ca/

Engagement. (2017). In *Oxford English dictionary*. Retrieved online: http://www.oed.com.ezproxy.library.ubc.ca/.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255-284.

Fredricks, J., Blumenfeld, P., & Paris, A. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109. Retrieved online: http://www.jstor.org.ezproxy.library.ubc.ca/stable/3516061

FreshGrade. (2016). *FreshGrade logo and icon* [product icons]. Retrieved online: https://www.freshgrade.com/media-kit/

Fullan, M. (2012). *Stratosphere: Integrating technology, pedagogy, and change knowledge*. Don Mills, ON: Pearson.

Fullan, M. (1995). The school as a learning organization: Distant dreams. *Theory into Practice, 34*(4), 230.

Gagné, R. M., & Briggs L. J. (1992). *Principles of Instructional Design* (5th ed.). New York, NY: Holt, Rinehart, & Winston.

Google Suite. (2016). *G Suite logos* [product icons]. Retrieved online: https://gsuite.google.com/setup/resources/logos/

Gorder, L. M. (2008). A study of teacher perceptions of instructional technology integration in the classroom. *Delta Pi Epsilon Journal, 50*(2), 63-76.

Great Schools Partnership. (2016). The glossary of education reform: Student engagement. Retrieved online: http://edglossary.org/student-engagement/

Hargreaves, A., & Shirley, D. (2009). *The fourth way: The inspiring future for educational change*. Thousand Oaks, CA: Corwin.

Hattie, J. (2009). *Visible learning: A synthesis of 800+ meta-analyses on achievement*. London: Routledge.

Hobbs, R. (2010). Digital and media literacy: A plan of action. Washington, DC: Aspen Institute. Retrieved online: http://www.knightcomm.org/wp-content/uploads/2010/12/Digital_and_Media_Literacy_A_Plan_of_Action.pdf

Hobbs, R. & Jensen, A. (2009). The past, present, and future of media literacy education. *Journal of Media Literacy Education, 1*, 1-11.

Kaser, L., & Halbert, J. (2017). *The spiral playbook: Leading with an inquiring mindset in school systems and schools*. C21 Canada.

Mathison, S. & Ross, E. W. (Eds.). (2008). *Battleground schools: An encyclopedia of conflict and controversy*, 2 Volumes. New York, NY: Greenwood.

Media. (2017). In *Oxford English dictionary.* Retrieved online: http://www.oxforddictionaries.com/

McLaughlin, M. & Talbert, J. E. (2006). *Building school-based teacher learning communities: Professional strategies to improve student achievement.* New York, NY: Teachers College Press.

McLuhan, M. (1967). The medium is the message. *NEA Journal, 56*(7), 24-27.

Milton, P. (2015). Shifting minds 3.0: Redefining the learning landscape in Canada. Retrieved online: http://www.c21canada.org/wp-content/uploads/2015/05/C21-ShiftingMinds-3.pdf

Ministry of Education. (2012). Standards for the education, competence & professional conduct of educators in British Columbia. Retrieved online: https://www.bcteacherregulation.ca/documents/AboutUs/Standards/edu_stds.pdf

Moll, R. & Krug, D. (2008). Using web 2.0 for education programs on global citizenship: Addressing moral and ethical issues. *Our Schools/Our Selves, 17*, 107-115.

National Center on Universal Design for Learning. How has UDL been defined? (n.d.). Retrieved Mar. 15, 2016, from" http://www.udlcenter.org/aboutudl/udldefined

Natriello, G. (1984). Problems in the evaluation of students and student disengagement from secondary schools. *Journal of Research and Development in Education, 17*(4), 14-24.

OECD (2015). Students, computers and learning: Making the connection. Retrieved online: http://www.oecd.org/publications/students-computers-and-learning-9789264239555-en.htm

Owen, S. (2014). Teacher professional learning communities: Going beyond contrived collegiality toward challenging debate and collegial learning and professional growth. *Australian Journal of Adult Learning, 54*(2), 54-77.

Parsons, S. A., Nuland, L. R., & Parsons, A. W. (2014). The ABCs of student engagement. *Phi Delta Kappan*, 95(8), 23-27.

Parsons, J., & Taylor, L. (2011). Improving student engagement. *Current Issues in Education*, *14*(1).

Penuel, W. R. (2006). Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education, 38*(3), 329-348.

Petrina, S., Feng, F., & Kim, J. (2007, April 19). Researching cognition and technology: How we learn across the lifespan. Retrieved online: https://www.academia.edu/5065656/RESEARCHING_COGNITION_AND_TECHNOLOGY_How_We_Learn_Across_the_Lifespan

Petrina, S. & Rusnak, P. (2010). Technology. In C. Kridel, (Ed.), *Encyclopedia of Curriculum Studies*. (pp. 876-878). Thousand Oaks, CA: SAGE Publications, Inc.

Premier's Technology Council. (2010). *A vision for 21st century education.* Retrieved online: http://www.gov.bc.ca/premier/technology_council/

Prensky, M. (2006). Listen to the natives. *Educational Leadership, 63*(4), 8-13.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*: 223–231.

"Privacy Impact Assessment Process." (2016). *Privacy Impact Assessment*. Ministry of Technology, Innovations, and Citizens' Services.

Riveros, A., Newton, P., & Burgess, D. (2012). A situated account of teacher agency and learning: Critical reflections on professional learning communities. *Canadian Journal of Education*, 35(1), 202-216.

Rosefsky, S. A & Opfer, V. D. (2012). Learning 21st century skills requires 21st century teaching. *Phi Delta Kappan, 94*(2), 8-13.

Schlechty, P. C. (2001). *Shaking up the schoolhouse: How to support and sustain educational innovation*. San Francisco: Jossey-Bass.

Schlechty, P. C. (2011). *Engaging students: The next level of working on the work*. San Francisco, CA: Jossey-Bass.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571-81.

Skinner, E. A., & Pitzer, J. R. (2012). Developmental dynamics of student engagement, coping, and everyday resilience. *Handbook of research on student engagement* (pp. 21-44). New York, NY: Springer.

Stoll, L. (2007). *Professional learning communities: Divergence, depth and dilemmas*. Open University Press [Imprint]. This is in Adobe Digital Editions folder.

Strom, P., Strom, R., Wing, C., & Beckert, T. (2010). Adolescent learning and the internet: implications for school leadership and student engagement in learning. *Education Digest: Essential Readings Condensed for Quick Review, 75*(6), 10-16.

Teague, G. M., & Anfara, V. A. (2012). What research says: Professional learning communities create sustainable change through collaboration. *Middle School Journal, 44*(2), 58-64.

Thessin, R. A., & Starr, J. P. (2011). Supporting the growth of effective professional learning communities districtwide. *The Phi Delta Kappan, 92*(6), 48-54.

Topor, D. R., Keane, S. P., Shelton, T. L., & Calkins, S. D. (2010). Parent involvement and student academic performance: A multiple mediational analysis. *Journal of Prevention & Intervention in the Community*, *38*(3), 183–197.

Tyler, R. W. (1949). *Basic principles of curriculum and instruction*. Chicago: University of Chicago Press.

Wepner, S. B., & Tao, L. (2002). From master teacher to master novice: Shifting responsibilities in technology-infused classrooms. *Reading Teacher, 55*(7), 642-51.

Wilson, K. L., & Boldeman, S. U. (2012). Exploring ICT integration as a tool to engage young people at a flexible learning centre. *Journal of Science Education and Technology, 21*(6), 661-668.

Wood, D. R. (2007). Professional learning communities: Teachers, knowledge, and knowing. *Theory into Practice, 46*(4), 281-290.

Appendix A: Innovation Grants 2015-2016

The School District is pleased to offer **Innovation Learning Grants** intended to provide opportunities for a team of teachers (minimum of three teachers per project with the involvement of the Principal/Vice-Principal) to work together on an in-depth inquiry/ action research project.

Inquiry is a study responding to a worthy question, issue, problem or idea. It is research/ evidence based with measurable outcomes. Inquiry/ action research is based on the belief that understanding is constructed in the process of people working and conversing together as they pose and solve problems, and make and test discoveries that arise in the course of the shared activity.

Innovation Learning Grant Criteria:

- Compelling In-Depth Inquiry/ Action Research Question
  - Research/ Evidence Based
- Identified Measurable Outcomes

Broad Topics of Inquiry:

- Student Engagement; e.g. Inquiry, project, problem and passion based learning, Universal Design for Learning, social emotional learning, self-regulated learning etc.
- Communicating Student Learning; e.g. Core competencies; balanced assessment; descriptive feedback; self-assessment; digital portfolios; assessment as learning etc.

Successful school teams must agree to the following:

- Attending two meetings:
  - Thursday, November 5th at 3:30 p.m. (Learning Services Meeting Room)
  - Thursday, June 2nd at 3:30 p.m. (Learning Services Meeting Room)
- Preparing a final presentation for the June 2nd meeting to:
  - Share their school inquiry/ action research question, resources and reflections with school and district colleagues;
  - Demonstrate the impact of the inquiry/ action research on student engagement and learning.
- Reporting on the use of the grant funds (unused funds will be returned to the district).

Please turn over for the Application Process.

Application Deadline: Friday, October 23, 2015

Please complete this application form and submit on or before Friday, October 23, 2015 to

MN, District Vice-Principal, Student Learning Services

Provide a description of your proposed project (no more than one page), using the following headings:

1. **List of Participants:**
   - Minimum of three teachers from the same school (include school);
   - Principal/Vice-Principal involvement.

2. **In-Depth Inquiry/ Action Research Question and Project Outline.**

3. **Research/ Evidence to support the In-Depth Inquiry/ Action Research Project.**

4. **Measurable outcomes (including how you will measure and report on them).**

5. **Amount of funds requested with a budget of intended expenses. NOTE: school teams may apply for $ 500 to $ 3000 maximum (depending on the scope of the inquiry project and the size of the team).**

Appendix B: Summary of Literature Reviewed

Table 1: Inclusion and Exclusion Criteria:

Inclusion criteria	**Exclusion criteria**
Pertaining to K-12 education	University, college and early learning education
Papers published in a peer-reviewed journal or scholarly book.	Papers published by other sources such as private publications and private companies.
Papers and books accessed via academic databases such as ERIC, UBC SUMMONS, EBSCO, Academia.edu, and JSTOR	Papers and books accessed via newspapers or Wikipedia
Papers published in English	Papers not published in English

Table 2: Media and Technology (student engagement):

Name of article/book	**Author/Year**	**Synthesis**	**Methodology/Study**
A study of teacher perceptions of instructional technology integration in the classroom	Lynette Molstad Gorder 2008	Differences of use to M & T based on grade level	174/300 teachers response rate Survey TISCM model similar to TIMS
Digital natives, digital immigrants	Marc Prensky 2001	How students brains have changed	synthesis of research
Educators engage digital natives and learn from their experiences with technology	John M. Downes and Penny Bishop 2012	Digital natives Attributes of M & T that are engaging	Six year study Interviews, Participant observations - Homogeneous pop.
Exploring ICT integration as a tool to engage people at a learning centre	Kimberley Luanne Wilson, Suzi Ursula Boldeman 2011	ICT integration as an effective way to revitalize disengaged students	4 year longitudinal Observations, interviews Qualitative analysis
From master teacher to master novice: Shifting responsibilities in technology-infused classrooms	Shelley B. Wepner and Liqing Tao 2002	Teacher responsibilities change due to technology	4 teachers experiences Interviews and observations
ICT literacies and the curricular conundrum of calling all complex digital technologies "tools"	Jenny Arntzen, Don Krug, Zhengyan Wen 2008	Misleading to call digital technologies a tool	Review of literature 1995-2008
Media and method	Richard E. Clark 1994	Response to criticisms Instructional methods are the common elements of all media	Synthesis of research

Media will never influence learning	Richard E. Clark	Summarize reactions to claim "media do not influence learning or motivation"	Synthesis of research
Teacher technology change: How knowledge, confidence, beliefs, and culture intersect	Peggy A. Ertmer Anne T. Ottenbreit-Leftwich 2010	Teachers as an agent of change - teacher education and Pro-D	Literature discussion
The effects of technology integration on student engagement	Banitt, Theis, Van Leeuwe, 2013	Incorporating technology to increase student engagement	Three teachers, 200 students, grades 8-12 Surveys, observations, questionnaires
The effects of technology on engagement and retention among upper elementary Montessori students.	Justin E. Tosco 2015	Preference for lessons that included technology	6 week study 25 students Questionnaire, report form

Table 3: Student Engagement:

Name of article/book	**Author/Year**	**Synthesis**	**Methodology/Study**
Developmental dynamics of student engagement, coping, and everyday resilience	Skinner Pitzer 2012	Self-determination theory - self, action, & outcomes	
Does active learning work? A review of the research	Prince 2004	Active learning	
Engaging Instruction in middle school classrooms: An observational study of nine teachers	Raphael, Pressley Mohan 2008	Variety of teaching practices, teacher relationship	Observations 9 classrooms 2 schools
Improving student engagement	Parsons, J., & Taylor, L. (2011).	Past research focused on disengaged, current research is on revision of schools + do students need to be engaged in all areas + how is SE measured + gap b/w what teachers say and what students say is SE	Synthesize research to 6 categories of what could be used to engage students
Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the	Skinner Belmont 1993	Teacher involvement and relationship correlated with emotional engagement; Reciprocal influences	Empirical Survey, longitudinal 144 children, 14 teachers - white, middle class,

school year			suburban and rural Reports – scaled Cross-sectional design
Problems in the evaluation of students and student disengagement from secondary schools	Natriello 1984	Indicators of behavioural and emotional disengagement	Surveys interviews with students - mainly white, middle class students
Promoting student engagement in the classroom	Bundick, Quaglia, Corso, Haywood 2014	Student, teacher and content interact is the conceptual model	Analytic essay Synthesis of research
School engagement: potential of the concept, state of the evidence	Fredricks, Blumenfeld Paris 2004	SE is malleable & multi-faceted; Behavioural, emotional, cognitive + need for more research	Qualitative Synthesis of research
The ABC's of student engagement	Seth A. Parsons, Leila Richey Nuland and Allison Ward Parsons 2014	Affective, behavioural & cognitive dimensions	
Motivation and new media: an introduction to the special issue	Ruth V. Small 2011	Media as a motivator for learning	
A purposeful approach to providing students with laptops	Mike Keppler, Spencer C. Weiler and Dan Maas 2014		quantitative and qualitative data

Table 4: Professional Learning Communities:

Name of article/book	**Author/Year**	**Synthesis**	**Methodology/Study**
A situated account of teacher agency and learning: Critical reflections on PLCs	Augusto Riveros, Paul Newton and David Burgess 2012	PLC need to be embedded in teachers' practices and professional learning	Synthesis of research
Building School-Based Teacher Learning Communities: Professional Strategies to Improve Student Achievement	McLaughlin, M.W Talbert, J.E 2006	Learning communities are essential to create change and empower teachers	Stanford's Center for Research on the Context of Teaching 15 years
The Fourth Way	Andy Hargreaves Dennis Shirley 2009	Reforms in student learning and achievement	Synthesis of research Analysis of worldwide projects
The Innovator's Mindset	George Couros 2015	Creating an innovator's model	Synthesis of research
Professional Learning Communities at Work:	DuFour, Richard Eaker, Robert	Authors are both academics and	Synthesis of research, theory and practice

Best Practices for Enhancing Student Achievement	1998	educators in K-12 system	
Professional learning communities: Teachers, knowledge, and knowing	Diane R. Wood 2007	Teachers as researchers and creators of pedagogy	Five year study, Mid-Atlantic urban school district, low socio-economic school
Supporting the growth of effective PLCs districtwide	Rebecca A. Thessin and Joshua P. Starr 2011	Analysis of 3 year PLC implementation plan	20 schools three year project
The identification of successes and barriers in establishing PLCs from principals' perspectives	Katie Carol Clarke 2014	Identify successes and challenges of establishing a PLC	mixed methods study 25 school districts online survey focus group
The school as a learning organization: Distant dreams	Michael Fullan 1995	Failure of reform movements, schools as learning organizations	synthesis of research
What research says: professional learning communities create sustainable change through collaboration	Ginger M. Teague, Vincent A. Anfara Jr. 2012	Method to bring about sustainable change	Synthesis of research

Appendix C: FreshGrade Consent Form

To Parents and Guardians of Division XX, Feb, 09, 2016

Our class has begun participating in a school pilot of a portfolio assessment tool called *Freshgrade.* It is a web-based tool that connects parents, teachers and students with the goal of better understanding, aiding and communicating student learning and assessment.

In our classroom, there is so much learning that is not easily captured on paper through quizzes or written assignments. This is particularly the case in subjects such as Gym, Music, Art, Science, or any subject which has a large oral or hands-on component. I am interested in documenting this learning through photo, video and audio clips.

Your child now has their own private e-portfolio for organizing photos and video of various classroom activities. Our FreshGrade portfolio space is password protected and limits access exclusively to our class community. Furthermore, parent access is limited to their own child's portfolio. However children often work collaboratively on classroom projects and presentations and it is valuable for this group learning to be documented as part of the assessment and sharing process. Thus, some photos will be "group media", photos and video which include multiple children and are therefore shared in multiple student portfolios simultaneously. Before sending the invitation to all parents, I would like to determine if there are families who do not wish for their child to be included in such group media.

Please understand that all media captured in FreshGrade will remain password protected and access will be limited to members of our classroom community (students and parents). FreshGrade portfolios are not public spaces. Accordingly, as part of the terms of use for this tool, you are asked not to reproduce or share any group images outside of FreshGrade.

You will soon be sent an email invitation from FreshGrade with your parent access information. At that time, you will be able to view and comment on your own child's portfolio items.

Please fill out the attached form and return it as soon as possible.

Thank you,
Teacher Name

By signing below, I give permission for my child to be included in group photos and video for the purpose of documenting and communicating learning in FreshGrade. As the parent and student I also understand that media on FreshGrade is not to be reproduced with the intent to share publicly outside of FreshGrade.

Student Name _____ **Date** _____

Student Signature _____ **Parent Signature** _____

Email Contacts _____ _____

Appendix D: The Boat Challenge

Learn about density by designing and 3D printing model boats.

This activity departs from what is conventionally done in that students do not solely determine the density of various isolated objects. Instead, students use the inherent property of 3D printing, infill, to test density. By adjusting the percentage of infill of a 3D printed object, represented in the form of a boat, students get to determine and control its density. They are able to observe the gradual effect this has on the boat's ability to float not only in water but in other fluids. Students can design boats that float in water but sink in another fluid, or boats that are suspended within fluids. With the use of 3D printer students have the power to test multiple versions quickly and efficiently in the classroom. A similar lab that does not use 3D printing may require students to use materials to test density that are not water resistant (paper, wood) and require more time to construct into a testable object.

Overview

Density is a physical property of matter that is derived from dividing an object's mass by its volume. From a practical standpoint, density is the reason why objects are able to float on or sink in fluids. Metals like iron and copper have a density that is greater than the density of water, thus metals sink in water. Marshmallows have a density that is less than that of water and so marshmallows float on water. Although boats have a large mass, boats also have a large volume, resulting in a density that is less than that of water and thus boats float on water. If the density of a boat was to change, for example due to water intake, the boat would gradually start to sink. In this lab activity students will 3D print boats of various infill percentages, a property that can be adjusted in the Settings menu in the Tinkerine Suite software, which produces boats of different densities. Students will consequently be able to observe the effect of gradually changing a boat's density on the boat's ability to float and they will be able to develop boats that will float in one fluid (e.g. water) yet sink in another (e.g. oil).

Teaching days required: 2 - Before day 1, print sets of boats with varying infill percentages (e.g. 5, 15, 40%) for students working in groups.

Day 1: Teach density principles, students working in groups find the densities of the boats printed beforehand and relate it to infill, test how well they float in water and oil, produce a density vs infill graph
Day 2: Using the graphs produced the previous day, students extrapolate infill percentage required for a boat to float in water but sink in oil, 3D print boats with infill values they determined and test

Rationale: Why incorporate 3D Printing (3DP)?

Students typically learn about density by learning how to derive the value and subsequently performing an activity to find the density of various objects like metals, wood and marshmallows. A common activity for students to do is to place these objects in water to determine if they will sink or float, as a means of illustrating the relationship between object density and its ability to float in water.

This activity departs from what is conventionally done in that students do not solely determine the density of various isolated objects. Instead, students use the inherent property of 3D printing, infill, to test density. By adjusting the percentage of infill of a 3D printed object, represented in the form of a boat, students get to determine and control its density. They are able to observe the gradual effect this has on the boat's ability to float not only in water but in other fluids. Students can design boats that float in water but sink in another fluid, or boats that are suspended within fluids. With the use of 3D printer students have the power to test multiple versions quickly and efficiently in the classroom. A similar lab that does not use 3D printing may require students to use materials to test density that are not water resistant (paper, wood) and require more time to construct into a testable object.

Materials required for teaching this lesson

- Tinkerine Ditto+ or Ditto Pro 3D printer
- Computer
- 2 - 250mL beakers
- Rulers
- Vegetable oil
- 100mL graduated cylinder
- Triple Beam Balances

Prerequisite Knowledge

Mass refers to the amount of substance present in a sample. Volume refers to the amount of space a sample takes up. Mathematically, if the mass of an object is divided by the object's volume, then what is derived is density.

Density, like melting point and colour, is a physical property of matter. A physical property is any property you can see, touch, hear, smell, or otherwise detect and measure without performing a chemical reaction. All substances have properties that we can use to identify them. In a well- known tale, Archimedes was tasked with determining whether King Hiero's goldsmith was embezzling gold during the manufacture of a golden wreath dedicated to the Gods and replacing it with another, cheaper alloy. Archimedes was not allowed to destroy or crush the wreath, so he decided to compare the density of pure gold with the density of the wreath. It turned out that the density of the wreath did not match with that of pure gold, and the King had been tricked.

Archimedes work using density resulted in a couple discoveries. First, the volume of an object (like an irregular shaped golden wreath) can be found through the displacement of water when the object was immersed in a water bath. Second, when the density of an object is greater than that of water, the object will sink; when the density of the object is less than that of water, the object will float.

DENSITY: STUDENT WORKSHEET

Introduction: Density is a physical property of matter that is derived from dividing an object's mass by its volume. From a practical standpoint, density is the reason why objects are able to float on or sink in fluids. Metals like iron and copper have a density that is greater than the density of water, thus metals sink in water. Marshmallows have a density that is less than that of water and so marshmallows float on water. Although boats have a large mass, boats also have a large volume, resulting in a density that is less than that of water and thus boats float on water. If

the density of a boat was to change, for example due to water intake, the boat would gradually start to sink. In this lab activity you will 3D print boats of various infill percentages, a property that can be adjusted in the Settings menu in the Tinkerine Suite software, which produces boats of different densities. You will consequently be able to observe the effect of gradually changing a boat's density on the boat's ability to float and be able to develop boats that will float in one fluid (e.g. water) yet sink in another (e.g. oil).

Purpose: Calculate the density of a solid, determine the relationship between an object's density and its ability to float on a fluid. Manipulate the density of a 3D object to test different densities.

Materials:

- Tinkerine Ditto+ or Ditto Pro 3D printer
- Computer
- Instructions for Making
- 2 - 250mL beakers
- Rulers
- Vegetable oil
- 100mL graduated cylinder
- Triple Beam Balances

Procedure

1. 3D print 5 boats with each boat having a different infill percentage. Download the boat file from the Tinkerine repository and refer to 3D print instructions to adjust infill percentage and to print
2. Using your triple beam balance, find the mass of the boats. Record your data in Table 1.
3. From the schematic drawing of the boat, find the volume of the boat. Record the volume in Table 1.
4. Calculate the density of each boat and record in Table 1.
5. Find the mass of the graduated cylinder. Record in Table 2.
6. Measure out 100mL of water in the graduated cylinder. Find the mass of the graduated cylinder containing the 50mL of water. Calculate the mass of 50mL of water by subtracting the mass of the empty graduated cylinder from the mass of the filled graduated cylinder. Find the density of water. Record in Table 2.
7. Pour 100mL of water into the 250mL beaker.
8. Repeat Step 6 with vegetable oil. Record values in Table 3. Pour the 100mL of vegetable oil into a separate 250mL beaker.
9. Place each of your boats into the beaker of water one at a time. Using a ruler, record how far above the bottom of the beaker the boat floats. Record your values as Float height in Table 1.
10. Repeat Step 8 with the beaker of vegetable oil.
11. Plot a graph with boat percentage infill plotted on the x-axis and boat density plotted on the y-axis.
12. Using your graph, what is the minimum density required for a boat to sink in vegetable oil but float on water? What percentage infill would this boat need?
13. 3D print a boat with the percentage infill you determined in Step 11.
14. Pour the 100mL of vegetable oil into the beaker containing the 100mL of water.
15. Put the 3D printed boat from Step 12 into the boat. Sketch the beaker, the layers of water and vegetable oil, and the position of the boat.

Appendix E: Student District Digital Technology User Agreement

The district is committed to ensuring that District digital technologies are used for educational purposes and that all users of such technologies are aware of their responsibilities for the acceptable use of these tools. Engaging in media and technology can promote learning, teaching and collaboration for students, staff, and parents. To gain access to the District Digital Technology, all students under the age of 19 must obtain parental permission and must sign and return this form to the their school. Students 19 and over may sign their own forms.

General Guidelines for Users:

1. District digital technology shall be used for educational and school-work related purposes.
2. Users will be informed of their rights and responsibilities as outlined in this policy.
3. User behavior online should reflect personal, classroom, and school community values. This means that the expected behavior of users is the same both in person and online.
4. Users will conduct themselves in a courteous, ethical, legal and responsible manner while using these systems. All Board policies and administrative procedures, including those on harassment, equity, and proper conduct of employees and students apply to the use of digital technologies.
5. Users are expected to demonstrate and show respect for themselves, peers, and other users they interact online and when posting and exchanging information online.
6. District digital technologies shall not be used for illegal or inappropriate purposes. Inappropriate use of district digital technology includes, but is not limited to:
    - transmission of materials in violation of Canadian Law
    - transmission, storage or duplication of pornographic material
    - transmission or posting of threatening, offensive or obscene material
    - transmission or duplication of material in violation of copyright law
    - plagiarism of works found on the internet
    - transmission of known false or defamatory information about a person or organization
    - threatening or harassment of others
    - attempts at unauthorized access to data, servers, or external services
    - impersonation or use of someone else's account or identity online
    - attempts to vandalize district or external systems, including malicious attempts to destroy data of another user, via virus or other means
    - use of abusive, vulgar, profane, obscene, harassing or other inappropriate language
    - posting of mail, photos, and information without permission of the author;
    - sharing of passwords with others
    - revealing of another person's personal address, phone number, picture, or other data without personal or parental consent, as appropriate
7. It is rare but possible to accidentally access inappropriate materials. Students are to immediately report such events to district staff and then return to appropriate materials.
8. Users will promptly disclose to their teacher, or the appropriate school or district employee, any message they receive which is inappropriate or makes them feel uncomfortable.
9. Users will install software on a District computer or computer system assigned for their use only where they are permitted to do so. Such software must be legally licensed.
10. Student Guidelines

a. Students under the age of 19 and their parent/guardian must sign a District Digital Technology User Agreement in order to access digital technology in Kindergarten, grade 6, grade 9 and/or year of entry into a New Westminster School. Students 19 and over may sign their own forms.
b. Students under the age of 19 and their parent/guardian must sign a Media, Photo, and Video release consent form to allow schools/teachers to commemorate, document and/or promote learning and various sports and educational events.
c. Students 19 and over may sign their own forms.
d. Students under the age of 19 and their parent/guardian must sign a Digital Tools consent form before using digital tools and apps for education. Students 19 and over may sign their own forms.

11. Parent Guidelines
    a. Parents are encouraged to have frequent proactive discussions with their children around their use of digital technology, internet and social media applications.

SCHOOL:
STUDENT DISTRICT DIGITAL TECHNOLOGY USER AGREEMENT

Name of Student:
School:
Grade:

In order to gain access to our District Digital Technology students and parents must read and discuss the terms and conditions of use as outlined in our Digital Technology guidelines. Student and parents will need to sign this agreement and return it to the school

As a user of XXX's Digital Technology, I have read this agreement and I hereby agree to comply with the above stated guidelines.

Student Signature:

As the parent or legal guardian of the minor student signing above, I grant permission for my son or daughter to access district digital technology. I understand that individuals will be held responsible for violations. I also understand that some materials on the Internet may be objectionable, but I accept shared responsibility with the school for guidance of Internet use – setting and conveying standards for my daughter or son to follow when selecting, sharing or exploring digital technology.

Parent Signature:
Date (mm/dd/yyyy):

Appendix F: Staff District Digital Technology User Agreement

The district is committed to ensuring that District digital technologies are used for educational purposes and that all users of such technologies are aware of their responsibilities for the acceptable use of these tools. Engaging in digital technology can promote learning, teaching and collaboration for students, staff, and parents. To gain access to the district digital technology all staff must sign this form.

General Guidelines for Users:

1. District digital technology shall be used for educational and school-work related purposes.
2. Users will be informed of their rights and responsibilities as outlined in this policy.
3. User behavior online should reflect personal, classroom, and school community values. This means that the expected behavior of users is the same both in person and online.
4. Users will conduct themselves in a courteous, ethical, legal and responsible manner while using these systems. All Board policies and administrative procedures, including those on harassment, equity, and proper conduct of employees and students apply to the use of digital technologies.
5. Users are expected to demonstrate and show respect for themselves, peers, and other users they interact online and when posting and exchanging information online.
6. District digital technologies shall not be used for illegal or inappropriate purposes. Inappropriate use of district digital technology includes, but is not limited to:
    - transmission of materials in violation of Canadian Law
    - transmission, storage or duplication of pornographic material
    - transmission or posting of threatening, offensive or obscene material
    - transmission or duplication of material in violation of copyright law
    - plagiarism of works found on the internet
    - transmission of known false or defamatory information about a person or organization
    - threatening or harassment of others
    - attempts at unauthorized access to data, servers, or external services
    - impersonation or use of someone else's account or identity online
    - attempts to vandalize district or external systems, including malicious attempts to destroy data of another user, via virus or other means
    - use of abusive, vulgar, profane, obscene, harassing or other inappropriate language
    - posting of mail, photos, and information without permission of the author;
    - sharing of passwords with others
    - revealing of another person's personal address, phone number, picture, or other data without personal or parental consent, as appropriate
7. It is rare but possible to accidentally access inappropriate materials. Students are to immediately report such events to district staff and then return to appropriate materials.
8. Users will promptly disclose to their teacher, or the appropriate school or district employee, any message they receive which is inappropriate or makes them feel uncomfortable.
9. Users will install software on a District computer or computer system assigned for their use only where they are permitted to do so. Such software must be legally licensed.
10. Staff Guidelines
    a. Staff must sign a District Digital Technology User Agreement at point of hire.

b. Staff will demonstrate digital citizenship, both during and outside of school hours, by conducting all related activities in a responsible, ethical, legal and respectful manner in accordance with professional codes of ethics and standards and the District Digital Technology User Agreement.
c. Staff will use dedicated school district sites and tools only for online communication with students and parents. Staff should obtain approval from their administrator when using other digital tools. All digital tools for communicating must comply with this policy and must be appropriately restricted i.e. to students in your class or activity.
d. No personal contact information about students is to be posted. Staff will outline their expectations and specific rules regarding digital technology use with their students.
e. Staff will use school based accounts for digital tools for educational purposes and communicating student learning. Staff will not interact with students in a non-educational manner with digital technology.
f. Staff will utilize appropriate privacy settings to control access to their personal social media sites.

STAFF DISTRICT DIGITAL TECHNOLOGY USER AGREEMENT

Name:
Site:
Street Address:
Home Telephone:

As a user of XXX's District Digital Technology, I have read the above guidelines. I acknowledge that, when I am granted District network and internet access using district digital technology, my use of media and technology, the Internet and district e-mail system will be conducted in an ethical and professional manner.

I agree that I will not use this access for personal use during scheduled hours of work. I also agree that personal use will not include inappropriate behavior such as: access to or downloading from offensive sites; personal (non work-related) postings to social media sites or activities for personal financial gain.

I understand that my use of the Internet and district e-mail is identifiable by others as a district activity and acknowledge that it is my responsibility to ensure that my usage does not contravene any laws or district regulations, including copyright laws and laws pertaining to obscene and discriminatory material. I agree to adhere to licensing agreements and I also agree that I will not transmit sensitive material over the Internet.

I understand that my usage may be monitored and that inappropriate usage may be cause for disciplinary and/or legal action.

Signature: _____ Date: _____

Appendix G: Media and Photo Release Form

MEDIA, PHOTO, AND VIDEO RELEASE
FOR THE 2016-2017 SCHOOL YEAR
SCHOOL:

Name of Student:_____ Grade:_____

It is XXX's tradition to allow staff and the media to photograph and film individual students and groups of students to commemorate, document, and promote learning and various educational sports and cultural events taking place in the schools and the district. While images and videos add to the community life of our schools, they are not required for educational purposes. Students' first names, photographs, video excerpts and comments may be published in the school yearbook, newsletter, or digital media and on occasion, in school district publications, annual report, digital media, or in the news media.

I give consent for the publication of my child's name, photograph, video excerpts and comments for purposes consistent with the above. This consent will be considered valid from the date at which it is signed until the end of the current school year, June 30.

Name of Parent/Guardian:_____ Date (mm/dd/yyyy):_____

Signature of Parent/Guardian:_____

Appendix H: Student Google Apps for Education Consent

FOR THE 2016-2017 SCHOOL YEAR

School:
Name of Student:
Grade:

XXX District provides students with access to Google Apps for Education (GAFE.) To use these services, the District will provide each student with a GAFE account, and a secure login and password which can be used to access the GAFE account and any documents or work product they create using GAFE. Schools are able to use these tools to facilitate collaboration between educators and students, and to monitor student use of these tools for educational and security purposes. Because Google's servers are located outside of Canada, we are required by the BC Personal Information and Privacy Protection Act to get consent to use GAFE in XXX. If the student is in grade 8 or lower, parental consent is required. If the student is in grade 9 or above, the student may provide their own consent.

Any data that is put on GAFE is the property of the student and the school district. Google cannot use any of the data for any reason, nor can they use any advertising whatsoever in the GAFE product.

GAFE involves the storing and accessing of the following types of information:
1. Student's name, grade level and school name to create the GAFE login account
2. Classroom assignments, research notes, presentations, school-based projects
3. Multimedia objects created by students (videos, pictures, audio files, animations, etc)
4. Quizzes, tests, surveys
5. Professional development materials and documents
6. Summative assessments (e.g., teacher comments, peer feedback)
7. Calendars for assignment dates, project deadlines, events
8. Communication with teachers and other students related to educational purposes

By signing this form, you are consenting to the collection, use and disclosure of this information through the use of Google Apps as described above for the school year of 2016/2017. I understand that the student's privileges to use the Google Apps is subject to his/her compliance with the Student Digital Technology User Agreement.

Name of Parent/Guardian:
Date (mm/dd/yyyy):

Signature of Parent/Guardian:

Appendix I: Summary of S1, S2 & S3 Data

Data Analysis Pros

Data	S1	S2	S3 -
Teacher knowledge/ interest	Opportunity to collaborate; had additional time due to student teachers; More personal and professional accountability (More on top of the new curriculum, reporting, communicating more regularly); More organized with reporting, communicating; Parents, students and teachers more accountable to learning	Needed a month to learn how to use the 3D printer To solve problems	Need someone to excite and motivate people & to show why and how it is exciting. Teachers found it easier to pick up as the students were able to transfer their skills learned in the one class to the other classes; had a push/pull strategy. Students pulled other teachers into using the Chromebooks;
Availability of technology	iPod is portable, shareable, discrete, easy to use, less intrusive Takes time but not time consuming	Access to Chromebook cart (30 devices); access to lab (30 desktops); both had to be booked.	Technology had to be readily available
Increased time on task: behavioural	The fact that the kids knew that they could be documented at any time improved their task. Teachers walked around with the phone taking photos of their work – students were redirected right away knowing that their work could possibly be posted. Time on task T1 class on average 27/29 students were on task; T2 21/23 students were on task, and T3 21/24 = 90% of class was on task.	Facilitated interactive in-class learning Created a more engaging, hands-on experience that inspires students to learn. S: It is so cool to have a 3D printer blows my mind, even the idea in general. More exciting than textbooks S: She decided to stay near the printer for the entire time. It was printing her boat for 38 minutes. She wanted to see how her boat would turn out. She wanted to try it out right away. S: It was fun to see it print and make things.	Higher percent of on-task behaviour through observation; kids who were normally off task wandering around the classroom – saw them sitting there, fully engaged trying to figure out how to use G Suite; Kids reported they felt they were more engaged- S: He was more focused in class because he was proud of his work using Google Slides. Survey results: 93% felt they were more actively involved.

		S: It made our class more interactive	
Increased emotional engagement	Increase in student and parent accountability Students were excited when work was posted and could not wait to get home to show their parents what they had done. S: It made me proud to show what I was doing. S: I wanted to share my work with my mom so that she could see what I was doing in the classroom S: I liked when I was given the iPod to take pictures of my work.	It equipped students for the future. They felt more emotionally invested in the assignments as they saw the 3D printer as advanced technology. Students said it gave an advantage in our next technological revolution in digital manufacturing.	Liked being able to collaborate and to improve end product; asked friends on the chat to help them. Student feedback was positive Students shared more often with each other; S: They could chat with friends while working; Body language changed less slouching, more face to face interactions, leaning over their work Facial expression changed – smiling, laughing, more interested, confident & proud of how far they had come: S: When he was stuck at home and did not know what to do he could go online and get help from people in his class: S: She became really proud of what she had done.
Increased cognitive engagement	Increase in overall completed assignments Increase in test scores due to study links being accessible online T: Students were more cognitively engaged. Their marks improved as evidenced by their marks on FreshGrade. T: Students became more accountable for their marks. T: Everyone, including parents, had the criteria	3D printer developed imagination and visualization skills: Concepts difficult to grasp were explained with 3D models as visual aids. Was easy to design and test prototypes. Students thought creatively to design their digital models using 3D CAD programs and build their designs. It improved problem-	Loved being able to do the work at home It helped improve the end product and it helped students to understand the task better and to be more successful; Marks went up; Students taught the other teachers and learning happened naturally T: Created more in depth projects and went beyond the scope of the books in the library.

	for an assignment = everyone knew the topic, the task and the due date. S: They studied more for my tests because they knew their parents would see their marks. S: They wanted to learn more so they could show their parents what they knew. T: Parents understand our teaching style and the learning that goes on in the classroom which meant they could better support their children at home.	solving skills with the use of prototypes to evaluate and improve the initial plan to solve problems. T: It was not mandatory, but almost everyone tried and worked after school to finish their experiments and calculations. Created hands-on experience which deepened students' understanding. Self-directed inquiry projects and 3D printer club created.	T: The internet allowed them to look for higher level materials to impress everyone with their knowledge; T: They took ownership for their whole project and their part S: The teacher's comments helped us to improve our project: T: Kids developed a deep level of knowledge because they would pose their own questions. T: Many of the assignments required students to create self-directed inquiry projects (half dozen) in their own time; S: They started to do more homework at home because they wanted to learn more things and I wanted to show their friends what they knew.
Increased parent engagement	Students with multiple homes/ parents can access anywhere, anytime; parents a new voice which was a catalyst for more meaningful conversations at home and less "What did you do at school?" "Nothing." Parents would know what kind of questions to ask their children. The teachers no longer had questions such as "How is my child doing?" Awareness of what is happening; felt like being a part of what is going on; helped in	My child would come home excited to share what they had done in Science class. T: Parents were asking to see what their child was learning	P: I enjoyed being able to see what my son had learned that week. When we ask him what did he learn we never get a clear answer from him.; P: My daughter could not wait until we got home to show us what had been posted on Google Classroom. We enjoyed learning about what she was doing in class; P: I work shift work and am not often home when my son comes home from school. Google Classroom let me see what he was doing and I

	asking specific questions; dialogue resulted; more involved in school work; opportunity to provide support; help enrich learning; ease of access to notices; Connected to school daily work; keeps us in touch with kids; virtual classroom program with regular updates; Easy to access; Verbal feedback was huge; we check daily for updates View count for posts: 28, 20, 36, 25, 28, 43, 36 = average views 31		could talk about it with him on the weekend. We could see when he was completing all his work. The parents were impressed with work; increased student success at achieving a better result at the end of the project; P: By increasing student enjoyment and collaboration and the desire to do their work, students are actually excited about doing their work.

Data Analysis Cons

Data	S1 - QQ	S2 - GMS	S3 - QMS
Availability of technology	Lap space was limited Used personal devices and then would forget to get them back from the person	Lab space was limited. Access to printer became limited due to popularity and time to print projects	Lack of access to labs: Tried to work in partners while using Chromebooks and the iPads.
Teacher Champion/ Interest	A lot of time was asked of the teacher champion. Difficult role to sustain year after year.	Once the teacher left the school the 3D printer was not used to the same extent; Teachers had to be interested:	Person who is off site and the champion cannot be there to have ongoing dialogues. Time needed was extensive.
Technology competency	T: The capability requirements for FreshGrade were not demanding. There was a learning curve; need to use more than a year to get the most out of what is available. P: (7) When asked what they identified as the barriers a common theme was that some aspects of the interface were not intuitive and that they felt they would have benefitted from learning how to respond	Needed a month minimum to learn how to use the software	Two 1st year teachers found the learning curve to be quite steep and were overwhelmed with the learning how to use GAFE.; Students - all the group managers were not technologically capable enough to make the posts.;

	appropriately.		
Engagement	Not all parents engaged, despite signing the form, direct correlation to parents who were not engaged and those students who are low performers Many parents wanted to comment, but were unsure of what to write or how to write a constructive comment. There were also approximately three to four parents in each class who accessed FreshGrade less than five times throughout the year	Not all parents engaged but this was not a requirement of the inquiry project	Not all parents were engaged or viewed their child's work; need to spend more time at the beginning of the year teaching parents about what G Suite Apps can do.

Appendix J: Google Apps Student Survey

Name: _____ Div. _____ Grade: _____ Date: _____

Digital Media - Student Questionnaire

1) I have taken Ms. C's 'Computer Exploratory' course before. Yes _____ No _____

2) I can design a 'Google Slides' Presentation that will capture and hold my audience's attention. (Circle a number.)

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) I feel confident in my ability to give an effective oral presentation using 'Google Slides.'

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments (if you have any):

_____

_____

_____

_____

_____

Name: _____ Div. _____ Grade: _____ Date: _____

Digital Media - Student Questionnaire

PART A

1) I have taken Ms. C's 'Computer Exploratory' course before. Yes _____ No _____
2) I can design a 'Google Slides' Presentation that will capture and hold my audience's attention. (Circle a number.)

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) I feel confident in my ability to give an effective oral presentation using 'Google Slides.'

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4) I can use the 'Google Slides' research, design, and communication skills learned in Ms. C.'s class in other classes.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5) The teacher's comments helped me make a better finished product.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6) Did other students comment on your work? ☐ Yes ☐ No
7) If answered 'Yes' to #6, respond to this statement –
"Other students' comments helped me make a better finished product."

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8) Do you comment on other students' work? ☐ Yes ☐ No
9) If you answered 'Yes' to #8, respond to this statement –
"I believe other students revised their work in response to my comments."

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Digital Media - Student Questionnaire (Cont'd)

PART B (Use extra paper if you need it.)

1) Using Google Apps/Google Classroom, how did you find your learning changed?

_____

_____

2) Using Google Apps/Goolgle Classroom, did you become more engaged (= involved, or interested) in your learning? ☐ Yes ☐ No

If yes, how did you become more engaged?

_____

_____

3) What did you like about working collaboratively (= working together with others)?

_____

_____

4) What could make working collaboratively better?

_____

_____

5) What do you like about using 'Google Documents' or 'Google Slides'?

_____

_____

6) What would make using 'Google Documents' or 'Google Slides' better?

_____

_____

7) What do you like about using 'Google Classroom'?

_____

_____

8) What would make using 'Google Classroom' better?

_____

_____

9) Do you have anything else to add?

_____

_____

Appendix K: Technology User Agreement – Student Jigsaw Activity

Name: _____ Date: _____

Technology User Agreement - Group Jigsaw Activity

(My group's point # _____)

Criteria:

- Make a poster for the wall.
- Make a slide or two to present to the class.
- Generate as many examples as you can think of to illustrate your point.

1. District digital technology shall be used for educational and school-work related purposes.

2. User behavior online should reflect personal, classroom, and school community values. This means that the expected behavior of users is the same both in person and online.

3. Users will conduct themselves in a courteous, ethical, legal and responsible manner while using these systems.

4. Users are expected to demonstrate and show respect for themselves, peers, and other users they interact online and when posting and exchanging information online.

5. District digital technologies shall not be used for illegal or inappropriate purposes.

Example

Technology User Agreement

1. District digital technology shall be used for educational and school-work related purposes.

Examples of what this is …	Examples of what this is not …

Note: The 'Technology User Agreement' applies to all technology, but especially group chats within documents and Google Hangouts.

Developed by C.C.