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ORIGINAL RESEARCH ARTICLE

Professional learning design framework: supporting technology integration in Alberta

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Researchers around the world are interested in knowing how to support teachers in developing both their technology skills and their understanding of how educational technologies can provide opportunity to engage all learners at their skill and interest level in learning activities that were not possible without technology. The solution involves the design and development of teacher professional learning (PL). This study examines a snapshot of one school district, which has experienced a growth in available digital student technology occurring at the same time when teachers experienced a loss of traditional pen and paper resources. Qualitative and quantitative data were gathered and analysed to determine what features of PL would best support teachers in this district. These findings were then considered within the scope of government suggested policy, frameworks and reports. The final suggested framework is for a PL that is collaborative, grade and subject relevant; offers hands-on opportunities; is supported by coaching; is based on research; and is supported by leadership which provides both time and a collaboratively developed vision.

Keywords: affordances; educational leadership; SAMR; UDL

Introduction

Many researchers and education policymakers are examining what integration features result in students engaging in technology-supported learning activities which previously were not possible and which engage all learners at differentiated skill and interest levels (Badia, Meneses, and Sigales 2013; Buabeng-Andoh 2012; Ertmer 2005; Hermans *et al*. 2008; Hew and Brush 2007; Inan and Lowther 2010; Mueller *et al*. 2008; OECD 2015; Zhao and Frank 2003). The features being studied include shared vision, leadership involvement, resources such as time and infrastructure, research-supported decisions and professional learning (PL) for teachers [Alberta Education 2013a, 2013b, 2016; Daniels *et al*. 2012; Edmonton Regional Learning Consortium (ERLC) 2016; International Society for Technology in Education (ISTE) 2008, 2009; Friesen 2009; Lowther *et al*. 2008; McKinsey and Company 2007]. This study focuses on determining what features of PL support teachers in acquiring the necessary skills to successfully integrate student technology in the classroom and take advantage of technology affordances. This is not the first study to look at this issue, but it is unique due to the circumstances of the teachers and in the district.

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Fort McMurray Catholic School District (FMCSD), a northern district in Alberta with approximately 5500 students, is similar to many other school districts in that it was experiencing rapidly increasing numbers of available student technologies. However, it was unique in that its school year was disrupted by a forest fire in May 2016. Due to the fire, teachers lost a majority of paper-based resources: lesson plans, worksheets, classroom posters, etc. Therefore, there was high motivation to learn how to use the newly available technology resources.

Problem statement and research questions

This study first outlines the views regarding integration of educational technology by examining provincial policy, frameworks and reports all within a worldview. It then analyses one local school district in order to suggest a framework for PL design that both supports the local group of teachers and is of interest to other districts. The approach considers the following questions:

1. What classroom activities using technology do FMCSD teachers currently assign to students?
2. Which of these classroom activities were made possible by using technology?
3. How are FMCSD teachers learning about the physical and action potential, or affordances, offered by technology and about pedagogy changes incorporating these affordances?
4. What design features of PL opportunities support teachers in integration of both new pedagogical practices and new ways for student to use technology?

Terminology

The PL approach to workplace learning places emphasis on learning as an active continuous process occurring over time that is directly related to work practices and involves a socially structured setting (Webster-Wright 2009). This is in contrast to professional development (PD), which historically focuses on distinct one-time instances of content delivery.

Technology integration in schools involves implementation of computers for effective and efficient use in meaningful curriculum-driven ways that enhance student learning by allowing for flexibility, creativity and collaboration, while making real-world connections (Dockstader 1999).

Affordances is the concept that objects not only have physical characteristics that we can perceive but also have action potential that must be perceived before it is possible to use the object to complete the actions (Gibson 1979). For example, a child who has experience with a touch screen will recognise a button that can be tapped, whereas a child who has never seen a touch screen might not 'perceive' that touching that shape on the screen will have any effect.

Background literature

While the focus of this study is to determine what features of PL support teachers in developing both technology skills and understanding of how affordances of educational technologies can provide new engaged learning opportunities to students,

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it is not possible to address this issue without first examining the wealth of research and framework solutions.

Why the focus on use of technology in schools?

Alberta Education (2016) states 'the availability of digital technologies has become widespread in classrooms across the developed world but it continues to be criticized especially in regards to its use by teachers and its impact on student learning' (p. 7). International research also expresses this view in that 'education systems are, on average, not ready to leverage the potential of technology' (OECD 2015, p. 190) or are not providing the envisioned learning environments (OECD 2013). Again, locally, in their review of research literature, Friesen and Lock (2010) state that:

> Teachers and leaders continue to struggle to create the types of learning environments that the learning sciences advocate made possible and powered by networked digital technologies and researchers continue to search for ways to adequately capture, analyze and interpret these new environments. (p. 17)

School districts around the world investing in student technologies are not seeing the expected results (OECD 2015, p. 5). Access to technology is not enough. 'Technology by and of itself does not lead to deep thinking or innovation. . . . drill and practice types of activities combined with tightly scripted lessons are not likely to foster ingenuity, deep thinking or sound habits of mind' (Daniels *et al*. 2012, p. 33). This research all the more supports the recommendation of Alberta Education (Daniels *et al*. 2012) that 'more research is needed on the disconnect between teachers' perception of innovative use of technology and what research has shown to be innovative use of technology in 21st century learning environments' (p. 10).

Recent history of implementation of technology in Alberta schools

The above research presents a picture wherein 'most schools and school districts are in the early phases of developing authentic and meaningful range of use of technology to sponsor deep learning' (Daniels *et al*. 2012, p. 38). Steps have been taken to adopt current research and guide schools in the development and integration of student technology. Here in Alberta, a series of policy statements and supports have been issued.

The Government of Alberta through consultation with the citizens of the province and within the framework of available research developed a vision for education in the province. This vision, 'Inspiring Education' (Alberta Education 2010) set out a 21st century view of learners who are 'engaged thinkers', 'ethical citizens' and who possess 'entrepreneurial spirits' (pp. 5–6). From this vision, certain core competencies were identified as essential skills for the next generation. Ministerial Order #001/2013 (Alberta Education 2013a) officially adopted the core competencies, which require students to develop 21st century skills such as demonstrate global and cultural understanding, manage information, be innovative and solve complex problems (p. 2–3). In 2013, Alberta Education also launched the 'Learning and Technology Policy Framework' (LTPF) that looked at how using technology supports the development of these competencies. The LTPF involves the following five areas of policy: student-centred learning; research and innovation; PL; leadership; and access, infrastructure and digital learning environments.

Current international view of integration of student technology

The Alberta situation can also be viewed with regard to how it fits within the international perspective. 'NMC/CoSN Horizon Report: 2016 K-12 Edition' reports that the role of the teacher is changing, and as such pedagogy approaches must also change. The teacher is no longer the expert, but rather, now must 'embrace a role of curating and facilitating learning experiences and encouraging student exploration to discover passions' (Adams Becker *et al*. 2016, p. 24). In order to support students in using digital tools in attempting these new learning approaches, PL for teachers must also change to involve 'social media, collaboration with other educators both inside and outside their schools, and online tools and resources' (Adams Becker *et al*. 2016, p. 24). A similar concern is raised in that 'the reality is that many teachers are not prepared to lead innovative, effective practices, and there is a kaleidoscope of systemic factors that must be addressed to resolve this complex issue' (Adams Becker *et al*. 2016, p. 28). This aligns with the research in Alberta.

The ISTE has developed a Standard (2008) regarding teachers and technology. The Standard assumes a high level of competence from teachers in the use of technology in the classroom and states that teachers will 'continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources' (p. 2). Disappointingly, it doesn't suggest how teachers will fulfil this standard. ISTE does, however, have its own set of essential conditions (2009) that lists a set of necessary conditions for successful integration of technology. It presents the longest list of necessary features, including those listed in the LTPF and such things as adequate funding, digital curriculum, assessment and evaluation, and community partnerships. It assumes that teachers are starting from a point of skilled individuals who will receive PL with 'opportunities with dedicated time to practice and share ideas' (ISTE 2009).

Suggested solutions from research: frameworks and guidelines

The first step in finding a solution often involves surveying the current situation. McKinsey and Company (2007) did such an international analysis and concluded that 'individual teachers need to gain understanding of specific best practices. In general, this can only be achieved through the demonstration of such practices in an authentic setting' (2007, p. 27). They went on to further explain that successful school systems 'create a culture in their schools in which collaborative planning, reflection on instruction, and peer coaching are the norm and constant features of school life. This enables teachers to develop continuously' (2007, p. 28). Jacobsen (2010) agrees with these ideas and opines that it is not enough if teachers simply learn to use current technologies. Teachers need continuous PL that involves peers in hands-on situations where they share and create together. In other words, teachers need to partake in the same learning situations that they should be designing for their students (para. 21). Friesen (2009) organises these ideas in a framework for teachers where the highest level of teacher scholarship requires that teachers work in collaboration when designing learning tasks, that they 'participate in school-based and online learning communities' (p. 12), and that they possess initiative in remaining current regarding teaching and learning research literature.

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All of the above suggestions regarding teacher PL can work for many areas of PL and not just integration of student technology. There is, however, an educational framework specific to examining the particular demands of integrating technology. The Technological Pedagogical Content Knowledge (TPACK) framework has been used as a guiding support in many studies. Koehler, Mishra, and Cain (2013) define it as follows:

> TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies, pedagogical techniques that use technologies in constructive ways to teach content, knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face, knowledge of students' prior knowledge and theories of epistemology, and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (p. 16) (see Figure 1)

TPACK has its uses; however, it often does not address additional issues such as the necessity for infrastructure, the need for leadership and, like the ISTE Standards, the question of how teachers will expand their knowledge in the three overlapping areas of the TPACK framework.

These issues are better addressed in a more general framework that addresses the overall issue of how successfully schools support implementation of any school initiative and not just those involving technology. ERLC developed such a framework, called 'Essential Conditions' (2010) (see Figure 2).

The issue of implementation of student technology does, however, also involve features distinct to technology use. Accordingly, Alberta Education (2016) in its 'Flexible Pathways' report outlines the following factors as necessary to support implementation of technology in the classroom (p. 5):

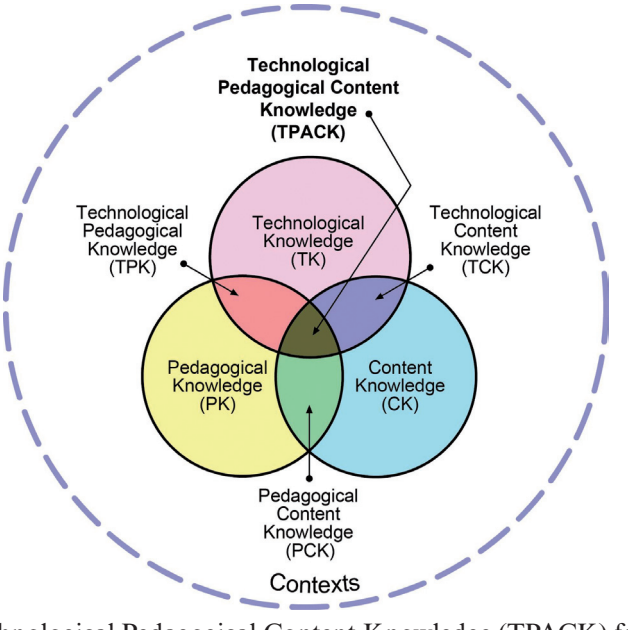

Figure 1. Technological Pedagogical Content Knowledge (TPACK) framework. Reproduced by permission of the publisher, © 2012 by http://tpack.org

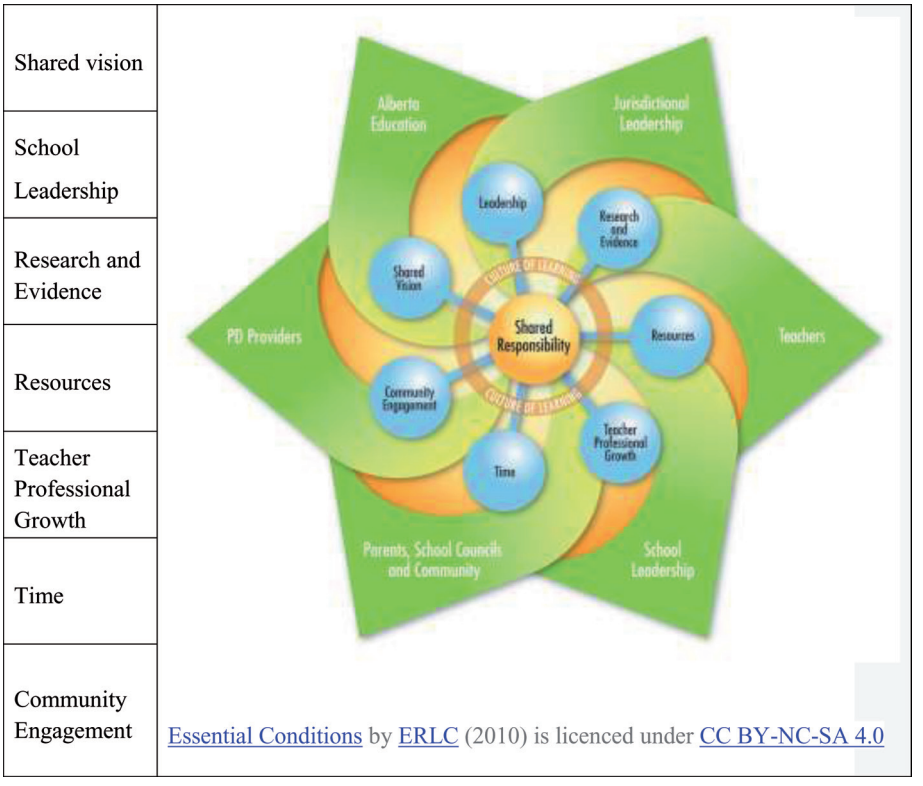

Figure 2. Essential conditions to support implementation.

- Resources, such as access to digital technology
- Leadership that supports Universal Design for Learning (UDL), the SAMR (Substitution, Augmentation, modification, and redefinition) model and use of the SETT (Student, Environments, Tasks, and Tools) process
- Teacher PL that involves collaboration

Alberta Education (2016) proposes a model for successful technology implementation in inclusive school settings (p. 46). According to this model, the features that support technology implementation are defined as drivers, which are categorised as being either leadership, organisational or teacher competency drivers (see Figure 3).

Several features of this model relate to teacher PL. Teachers need PL that is supported by coaching, that is collaborative in nature and that incorporates reflection in the learning process. Likewise, teacher PL needs to ensure that teachers are aware of potentially supporting frameworks such as SAMR and UDL.

Alberta Education (2016) states the role of the SAMR Model is to 'help teachers infuse technology into learning environments, not just replace chalk and paper with projectors and personal devices' (p. 30). The SAMR Model (Puentedura 2010) proposes that there are the following four stages of technology integration in classrooms:

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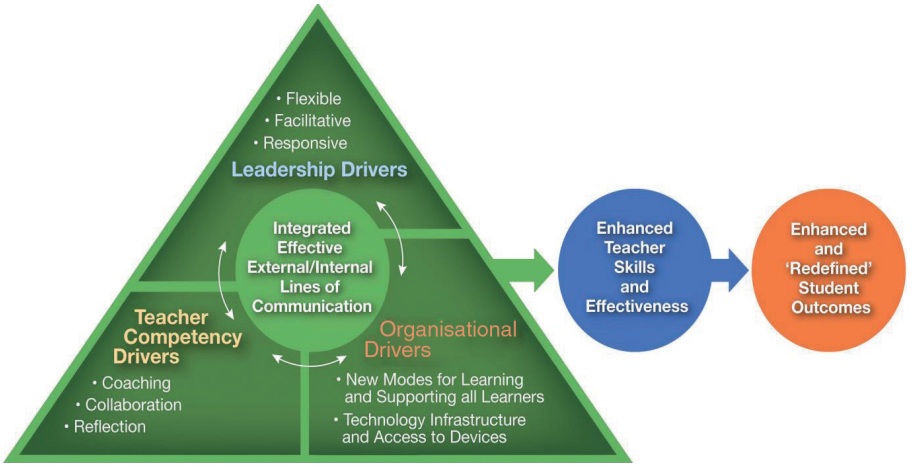

Figure 3. Model for successful technology implementation in inclusive school settings (Alberta Education 2016, p. 46). Used by permission from Alberta Education (2016).

1. Substitution: where the technology is used in place of paper or other physical resources.
2. Augmentation: where technology is used to enhance a learning activity that was designed using non-digital resources, but the basic task remains the same.
3. Modification: where technology is used in such a way that the learning task is fundamentally changed.
4. Redefinition: where technology allows for a learning task that was not possible without the use of technology.

UDL (Meyer, Rose, and Gordon 2014) is a framework used to guide lesson planning in such a way as to remove as many barriers in the learning process for as wide a range of learners as possible. It consists of the following three principles:

1. Engagement: learners need multiple ways to engage in the learning process.
2. Representation: material needs to be presented in multiple formats.
3. Expression: learners must have multiple ways to demonstrate what they know.

UDL is appropriate to include in discussions regarding the integration of technology in that the use of technology provides vital options in setting up multiple means of engagement, representation and expression.

Finally, ERLC (2016) developed a presentation that explains how the LTPF (Alberta Education 2013b) and Essential Conditions (ERLC 2010) align in relation to the findings of Flexible Pathways (Alberta Education 2016). They present 'An Emerging Model for Successful Technology Implementation in Inclusive Classrooms' (see Figure 4).

Methodology

This study employed a mixed method approach. The data collected focused on the teachers' perspectives regarding what technology-supported classroom activities they

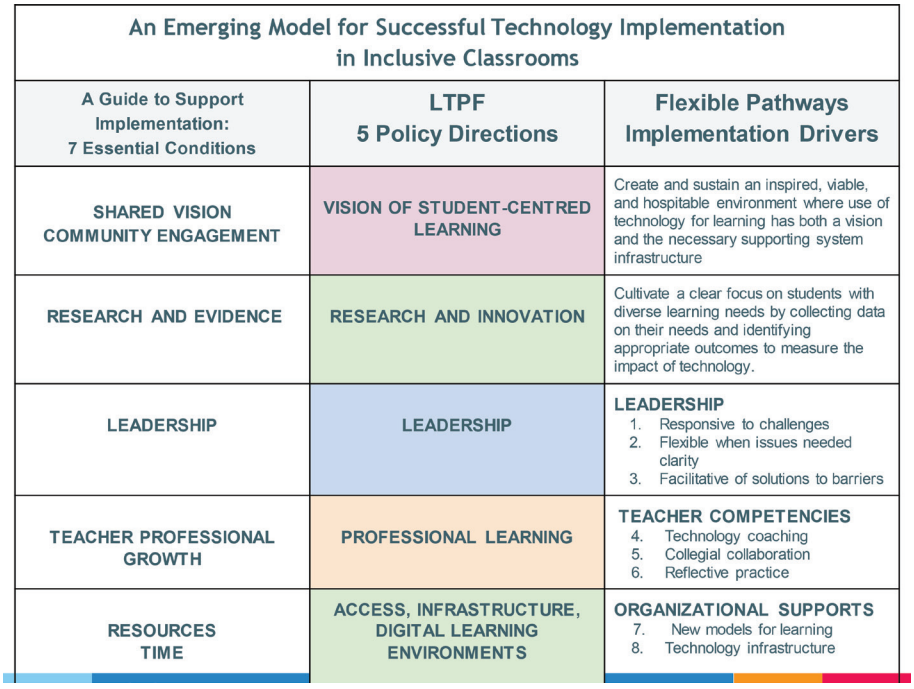

Figure 4. An emerging model for successful technology implementation in inclusive school settings ERLC (2016, slide 5). This image is licensed under CC BY-NC-SA 4.0 and used with permission of the licensee.

assign and on the teachers' views regarding PL to support them in the integration of student technology. Data were not gathered directly from students. Ethics approval was procured from both the Conjoint Faculties Research Ethics Board for the University of Calgary and the FMCSD Board.

The survey consisted of 18 questions, 1 which determined grade range of the teachers, 10 which focused on student use of technology and 7 which focused on teachers' views of PL (see Appendix A for full survey). Of the first 10, 8 were closed answer survey questions to allow for quantitative analysis and 2 were open-ended survey questions to allow for qualitative analysis. Likewise, for the second set of questions, 2 were quantitative and 5 were qualitative. Teachers were free to answer all questions or only those that they chose.

The survey questions were developed to align to The LTPF Toolkit as prepared by Galileo.org Education Network (2014) as part of a PL series which they designed to aid school districts across Alberta in implementation of the LTPF (Alberta Education 2013b). The questions also expand a prior survey (2014) that used the term PD. Although generous PL time is built into the teachers' annual work calendar, when requesting help with educational technology they still request PD and not PL.

The survey was administered via Google Forms as an anonymous digital online survey wherein completion of the survey implied consent. Teachers were emailed a link to the survey along with an explanation of how submission of the completed survey implied consent. The survey was emailed in October 2016 and left open for 2 weeks.

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Initial analysis of the quantitative data was made possible through the Google Forms graph feature, wherein a reporting graph of each question is automatically produced (see Appendix B). These graphs could easily be viewed to present a quick sense of the overall responses of the teachers. During analysis, the percentage of responses indicating the two highest level of technology integrations was compared with the qualitative data.

The analysis of the qualitative data involved both descriptive and simultaneous coding. Each written response was listed as a single unit in a spreadsheet, with a descriptive code attached. Segments that contained more than one potential thought were duplicated and assigned additional codes, as needed. This approach ensured that context was not lost, as can happen when quotes are split into smaller segments. It also guaranteed that all thoughts were coded and not only the most important thought for each response. The spreadsheet was then sorted and groups of similar coding emerged.

Findings

The survey was completed and submitted by 42 FMCSD teachers. This represents approximately 5.7% of the teaching staff, divided into grade categories, as represented in Figure 5.

This article argues that integration of digital technologies into classrooms requires carefully designed PL for teachers that is collaborative, grade and subject relevant; offers hands-on opportunities; is supported by coaching; is based on research; and is supported by leadership which provides both time and a collaboratively developed vision. Examination of the findings, question by question, reveals that the findings support the argument. What follows is a summary of the findings for each of the questions.

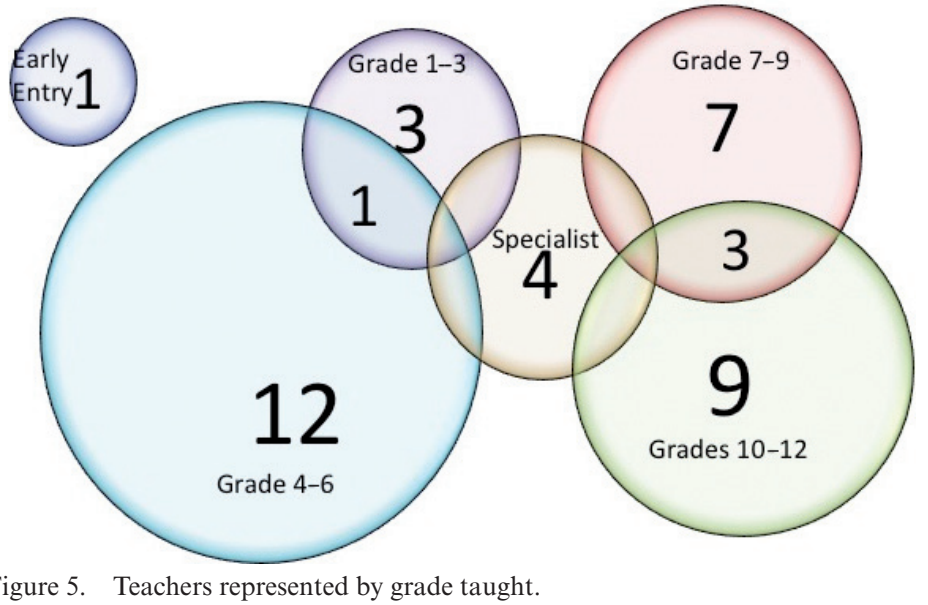

Figure 5. Teachers represented by grade taught.

Question 1: Current classroom activities using technology

The quantitative data compared with the qualitative do not paint any unified picture of how students use technology in the classroom. For example, approximately two-thirds of teachers indicated that their students use technology to monitor learning, but there was no mention of monitoring activities in the written responses (see Figure 6). Likewise, the most common written response, mentioned 10 times, of what students use technology for was 'online skill practice', but this is not even a selectable option in the original multiple-choice questions, as this type of activity is not considered an ideal goal regarding using technology. More interesting was that teachers used their replies to express either a benefit or concern regarding student technology rather than how students are using technology. Twenty of the responses expressed benefits to students from the use of technology and 12 expressed concerns.

Question 2: Classroom activities made possible by the use of technology

Regarding using digital technology to create, share and collaborate, the quantitative data are supported by the qualitative responses in that for both types of data, analysis indicates that approximately 50%, 43% and 38% of respondents have their students use technology for the purposes of creating, sharing and collaborating, respectively. There was an interesting lack of correlation in that 50% of respondents claimed that their students can create using digital technologies, but only 39% claimed that their students use digital technologies to express what they know. In other words, the teachers are not confident that the final artefacts produced by the students truly represent or can be used to assess students' knowledge. An even bigger discrepancy was found when comparing the results that approximately 68% of respondents indicated that their students monitor their own learning process, yet only 34% of the respondents indicated that their students make use of feedback in the learning process. This leads to the question of why, then, are students monitoring their learning if they are not using this information to then improve learning? It also points to teachers potentially lacking a pedagogical understanding of the purposes of students using feedback in supporting learning.

quantitative	percent	qualitative	**X** /27
Monitor learning	68%		
Use feedback	34%		
Access online information	62%	research	6/27
		Online skill practice	10/27
Create digital products	50%	Make presentations	6/27
Share digitally	43%	Digital communication	7/27
collaborate	38%		
		Online tools	4/27
		Differentiated learning	4/27
		Multiple format resources	4/27

Figure 6. Categories of tasks teachers report their students to be using.

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The findings can be expressed in terms of the SAMR framework. Online skills practice (10/30 or 33%) is the top answer, which is only possible with technology. Skill practice does happen, however, in many other ways in the classroom. This makes online skill practice a 'substitution' of technology in the place of pen-and-paper and not an activity that takes advantage of technology affordances. Some online skill practice programmes, however, can help the teacher by differentiating the questions to match student levels. This type of programme would be considered 'augmentation'. There is no way of determining from these data which type of online skill practice these teachers are providing their students. Missing from most of the respondents' list of learning activities technology makes possible were many 21st century skills, such as self-reflection, video production, projects, problem solving, inclusive classroom supports, assistive technology (AT) and collaboration, which were all only mentioned once or twice. These 21st century skills require learning tasks within the higher two levels of the SAMR Model.

The findings can also be viewed within the UDL framework. Things such as assignments, assessments, presentations, research, communication, differentiated learning and multiple format resources, even if only minimally used, indicate some understanding by the teachers that the use of technology does allow for incorporation of the UDL framework. Technology allows students to hand in work in a format other than written on paper. Teachers can express concepts in multiple formats (Meyer, Rose, and Gordon 2014) and thereby provide differentiation.

Question 3: Current PL practices regarding technology affordances and pedagogy

Both the quantitative and qualitative data gathered in response to this question reflect the similar findings as documented in the research, policy and frameworks as noted above.

Quantitative:

- Thirty-five per cent of the respondents are comfortable working online to develop teaching practice (21%) or to work in online established group settings (14%)
- Forty per cent have their students use technology to examine real-world problems

Qualitative

- Thirty per cent appreciate support from learning coaches/technology facilitators
- Twenty-five per cent rely on online resources or communities
- Twenty-five per cent acknowledge advantage from increased availability of student devices
- Twenty-five per cent acknowledge advantage from improved wireless networks
- Ten per cent acknowledge support of leaders

Question 4: Suggested PL design features

The preferred features for PL as suggested by the respondents are as follows:

- Thirty-two per cent want hands-on PL
- Thirty-five per cent want relevant PL that is specific to their needs
- Twenty-six per cent want PL that focuses on training them to use software
- Twenty-six per cent want PL that teaches pedagogy related to technology use with students
- Sixteen per cent want PL that is structured to provide time to practice using technology
- Ten per cent want PL that is collaborative

Discussion

This study and its findings focused on two areas of technology integration, namely, determining teacher views regarding student use of technology and determining their vision as to features of PL that would support them in further integration and use of technology by students. This was a small snapshot: it did not consider the view of students and parents, and the response from teachers was minimal. It did not specifically examine the role of administration nor delve deeply into the role that infrastructure and access plays in the integration of student use of technology.

Summary of the analysis of the teachers' understanding of student use of technology

There is limited reference in the responses from the teachers to the use of the UDL framework. It is not clear, however, if that is because teachers don't know about UDL, are unsure how to implement UDL, do not understand the support that technology can provide to UDL or have not yet had the time to make such changes in their teaching practices. Some teachers expressed recognition that student use of technology can support differentiation of instruction by providing students with multiple forms of engagement, representation and expression. There was a surprising lack of mention regarding the use of AT given almost every classroom from grade 3 and upwards has students with an individual student plan (ISP) expressly listing the use of AT. The devices dedicated to AT have gone from 10 devices in 2010 to 339 in 2016, and this number does not include the student-owned AT devices at school. It is possible, however, that this is such a standard feature that teachers did not think of mentioning it and instead focused on whole-class usage.

Whereas some technology is being used for higher-level learning, most is still at the substitution or augmentation level of the SAMR Model. Furthermore, only about 25% of the respondents recognise the need for specific pedagogy training in order to move towards using technology with lessons fitting the modification or redefinition levels of the SAMR Model. This might be due to the indication that 50% still see a need for learning how to use technology, including specific use of software and further digital resources. It is difficult for teachers to move forward in the SAMR framework without first having a minimum base level of confidence and competence in understanding how to use technology. Buabeng-Andoh (2012) states 'teachers' computer competence is a major predictor of integrating ICT in teaching' (p. 139).

In general, this presents a picture of teachers whose student learning activities are not taking advantage of the full range of possible affordances. They require training in the UDL and SAMR frameworks, as well as general training in the use of technology.

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Summary of teacher vision as to features of PL that FMCSD teachers are comfortable with using and the supports that they find useful

- Relevancy — Teachers are looking for PL that is relevant and includes time for hands-on practice. PL that is cooperative and grade and/or subject specific meets the need for relevancy.
- Support — Teachers look to a variety of sources for support including other teachers, district learning specialists and online resources.
- Access — Appropriate access to student technology and wireless network is an important support.
- Leadership — School-level leadership also plays a role.

Features or structures of PL suggested by the above two summaries

This is a summary of teacher views regarding student use of technology and teacher vision as to features of PL that support them in further integration and use of technology by students.

- Training — There is a need for both training to use technology and pedagogy, such as UDL and SAMR, which incorporates 21st century skills into student activities.
- Relevancy — Sessions should be grade and/or subject relevant, with teachers working together, guided by local experts, with time provided to learn and hands-on opportunities arranged.
- Access — Appropriate infrastructure is necessary, including devices and wireless networks.
- Leadership — School-level leadership needs to play a role.

Research would further suggest the following conditions be met

The above features of PL are incomplete. They also need to incorporate features suggested by an examination of current research literature.

- Leadership — Leadership must take an active part in guiding the PL sessions (Alberta Education 2013b, 2016; Buabeng-Andoh 2012; Daniels *et al*. 2012; ERLC 2010, 2016; Friesen and Lock 2010; ISTE 2009; McKinsey and Company 2007).
- Vision — There must be a vision guiding the overall PL (Alberta Education 2016; Daniels *et al*. 2012; ERLC 2010, 2016; Friesen and Lock 2010; ISTE 2009).
- Research — PL content should reflect current research (Alberta Education 2013b, 2016; Daniels *et al*. 2012; ERLC 2010, 2016; Friesen and Lock 2010).

Conclusion

This study potentially can guide staff and administration of FMCSD in future PL involving integration of student technology in the classroom. Future PL needs to incorporate the following features:

1. Sessions should be grade and/or subject relevant, with teachers working together, guided by local experts, with time provided to learn and hands-on opportunities arranged.
2. Availability of appropriate infrastructure and access to reliable student technology.
3. Clear leadership from both school site and district administration with a clear vision.

The best designed PL will still produce questionable results, however, if not supported by and based upon underlying research-based pedagogy. For integration of technology, the suggested frameworks are UDL and SAMR; therefore, PL should start with developing further understanding of these frameworks and incorporating them into lesson designs. At the same time, teachers need PL and support to ensure they develop competence and confidence in the use of digital tools themselves. An increase in numbers of student devices is not enough. Alberta Education (Daniels *et al*. 2012) in its report reminds us 'to not confuse the features of a 21st century learning environment with 21st century skills' (p. 53). When the focus is on providing an increase in digital tools and teachers learning how various digital tools work, this only results in setting up a '21st century learning environment'. There needs to be a focus on developing pedagogy and supports that integrate student technology in such a way as to develop students' '21st century skills'.

Finally, this study is only a starting point. It did not take into consideration the view or skills of students as expressed by the students themselves. Nor did it consult with stakeholders to determine their vision for the use of student digital tools. There also was no consideration of the design features to support a responsive PL experience based on evidence and evaluation of progress. The suggested course for further study involves the following design-based research steps (for visualisation see Figure 7):

1. Development of collaborative stakeholder vision, including student input
2. Determination of how success will be measured and evaluated
3. Development of PL plan which takes into consideration the above suggested PL features and the stakeholder vision
4. Implementation of PL plan which includes appropriate pre- and post-measurements
5. Evaluation of PL plan
6. Modification to PL plan based on evaluation

A final lesson from this study is that integration of digital technologies in the hands of students must be an ongoing practice. As noted earlier, the school environment of student technology is changing regarding digital tools made available to students. Also, according to Alberta Education (Daniels *et al*. 2012), 'school districts are missing an opportunity if they do not make use in the classroom of the technologies that student are comfortable with using outside the classroom' (p. 31). If this is the case, teachers must also possess the technology competence and confidence to keep up with the range of changing technologies that their students will bring into the classroom. The above suggested course for further study is capable of supporting teacher continuing PL through these changes in our digital world.

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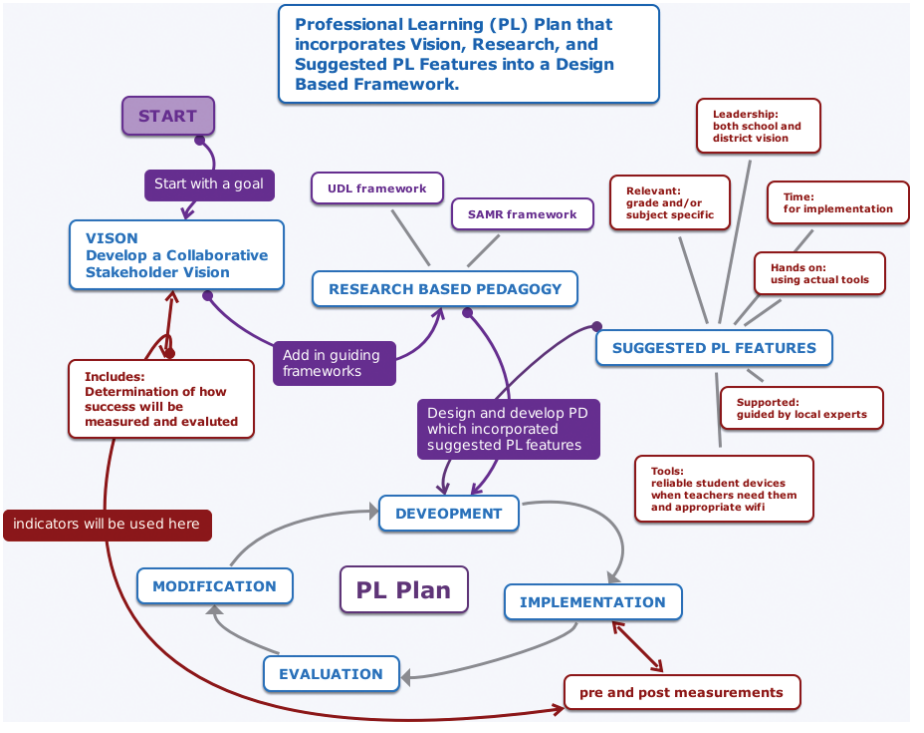

Figure 7. Professional learning (PL) design framework to support technology integration in Alberta schools.
Note: The underlying design framework is based on Branch's (2009) ADDIE framework of Analyse, Design, Develop, Implement and Evaluate.

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Appendix A

Survey

October 2016 FMCSD Teacher Tech Survey

https://docs.google.com/a/fmcsd.ab.ca/forms/d/19ToQFp1gveNHZZxnJRiiTYZ-L-3BluWHEDIW_VSAwX4E/edit

October 2016 FMCSD Teacher Tech Survey

This survey has a dual purpose: (1) to help determine the needs and direction for professional learning in the area of technology within FMCSD and (2) to assist me with a research study conducted as part of a graduate-level programme. As such, this survey is completely voluntary, but all responses are appreciated. If you complete the survey, it implies that you have given consent for the data to be used for these purposes. At any point while you are completing the survey, if you change your mind, just close the survey and your responses will be deleted. However, once you have submitted your completed survey, it will not be possible to return individual information. The survey is anonymous and does not track your email address, and responses are aggregated continuously during the survey response period. The full consent was attached in the email which delivered this survey; however, it can also be found here: goo.gl/Mot2DG

Grades I Teach

To help identify trends. (1 question)

1. Grade(s) that I teach (select all that apply)

Check all that apply

- Early Entry
- Kindergarten
- Grades 1–3
- Grades 4–6
- Grades 7–9
- Grades 10–-12
- Specialist

Skip to question 2

How My Students Use Technology in Class

To help understand how our FMCSD students are currently using technology. (8 + 2 questions)

2. Online access to information: Choose the statement that best describes how often your students access online information:

Mark only one oval

- Rarely
- Occasionally
- Frequently
- They have ubiquitous access

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3. Online access to information: When my students do access information online, they are able to:
Mark only one oval

- Determine if information is appropriate for the task
- Discern between information sources which one is more appropriate for the task
- Discern which information source is the most appropriate for the task

4. Creating with others: Choose the statement that best describes how often your students create using digital technology within their knowledge-building communities:
Mark only one oval

- Rarely
- Occasionally
- Frequently
- Regularly

5. Sharing with others: Choose the statement that best describes how often your students share using digital technology within their knowledge-building communities:
Mark only one oval

- Rarely
- Occasionally
- Frequently
- Regularly

6. Collaborating with others: Choose the statement that best describes how often your students collaborate using digital technology within their knowledge-building communities:
Mark only one oval

- Rarely
- Occasionally
- Frequently
- Regularly

7. Demonstrating what they know: Choose the statement that best describes your students' ability to demonstrate what they know using digital media:
Mark only one oval

- My students are constrained in their ability to effectively demonstrate, represent or express what they know.
- My students occasionally attempt different methods to demonstrate, represent or express what they know.
- My students often use more than one method to demonstrate, represent and express understanding appropriate to the task and to the discipline.
- My students use multiple methods to demonstrate, represent and express understanding appropriate to the task and to the discipline.

8. Student-centred learning: Choose the statement that best describes your students' monitoring of their learning progress:
Mark only one oval

- My students rarely gather or use evidence of their learning.
- My students gather summative data as the only evidence of their learning.
- My students gather summative and formative data as evidence of their learning in order to monitor progress and to inform the next steps.
- My students regularly gather a variety of evidence about their learning to monitor progress and to strategically determine decisions.

9 Student-centred learning: Choose the statement that best describes your students' use of feedback in their learning progress:
Mark only one oval

- My students rarely apply feedback.
- My students occasionally use criteria-based feedback to improve learning.
- My students frequently use criteria-based feedback to improve learning.
- My students consistently and regularly use feedback linked to specific criteria to improve learning.

10. What would you like to share with me about how your students use technology in your classroom?
11. What learning activities do you do with your students that would not have been possible without technology?

My PD Practices Wishes and Needs

To help with decisions regarding structuring tech PD support in our FMCSD schools. (2 + 5 questions)
12. Using technology to learn: I understand that technology use exists on a scale from basic productivity tools to being used in an online community setting to work through problems of practice. Where do I fit on this scale?
Mark only' one oval

- I mostly use technology as a productivity tool.
- I usually work alone but occasionally join in with online sharing groups.
- I frequently work with other teachers online to develop my teaching practices.
- I regularly work within an established group of like-minded teachers in an online setting to share resources and develop our teaching practices together.

13. Using technology to teach: I understand that technology use by students exists on a scale of basic use to complete tasks similar to pen and paper tasks to using technology in complex learning settings. Where do I fit on that scale?
Mark only one oval

- I have my students use technology to check their recall of facts.
- I have my students use technology to help make learning personally relevant and more connected to the world.

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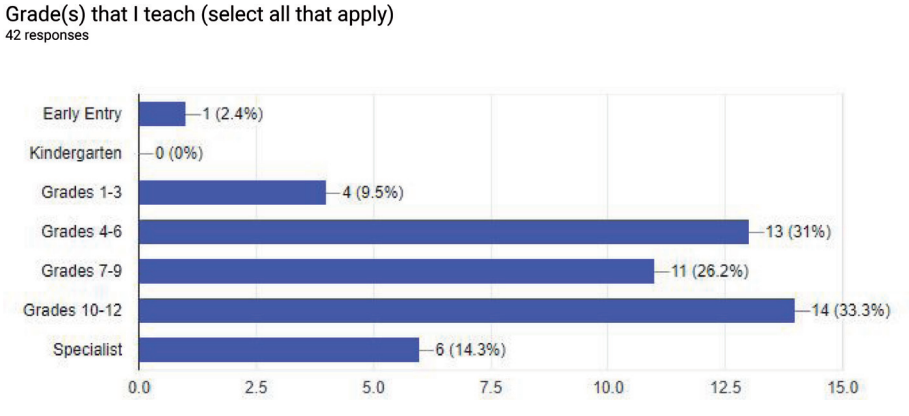
- I have my students use technology to examine real-world problems that are of interest to them and are central to the curriculum.
- I have my students use technology as noted above and help them find real work connections outside the classroom.

14. Can you describe your preferred professional learning (PD) session? What are the features of this preferred PD that make it a good PD session?
15. What additional types of PD do you like to take part in that are not organised by FMCSD or your school? What are the features of these PD sessions that you like?
16. Thinking of a time that you did successfully implement a student activity that was made possible by the use of technology, was there any support that made this possible for you and can you describe this support?
17. What is on your wish list for PD regarding learning about using technology in the classroom?
18. Thinking about yourself and all the teachers who are part of the FMCSD family, what PD needs regarding technology in the classroom do you see?

Appendix B

Graphs of Quantitative Responses

Question 1:



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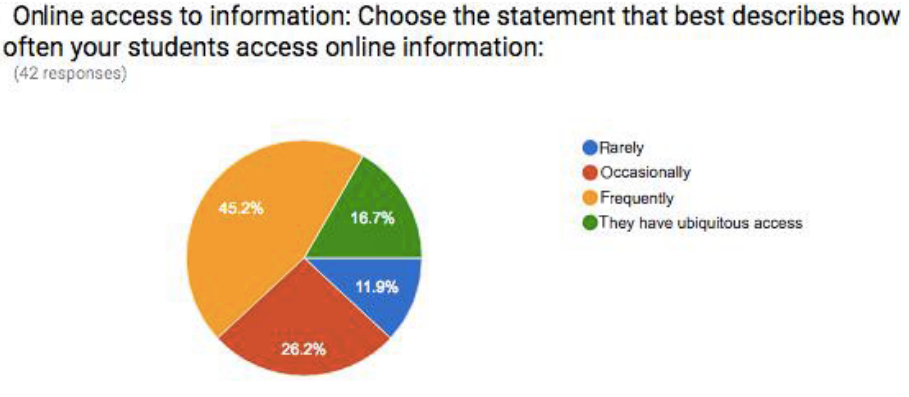

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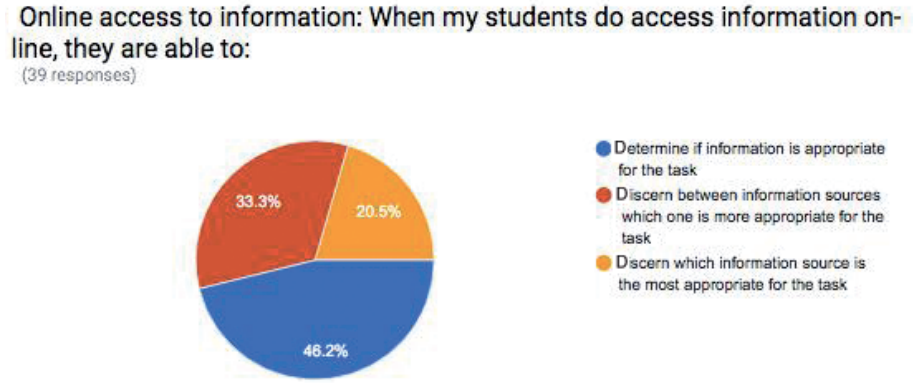

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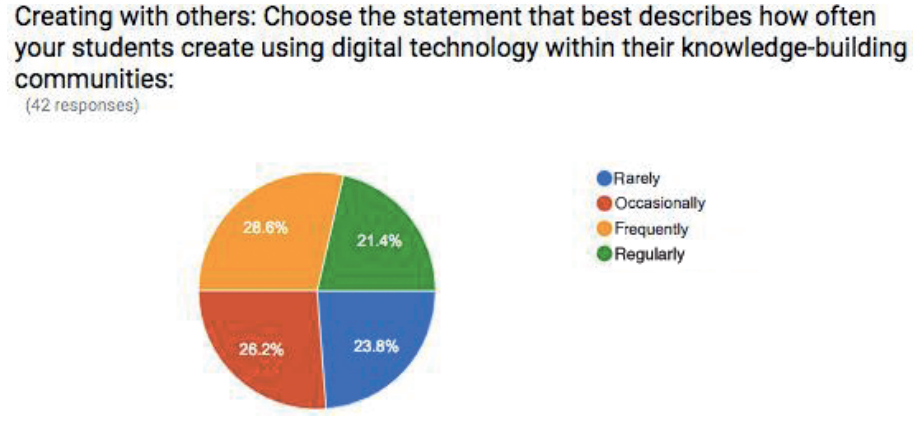

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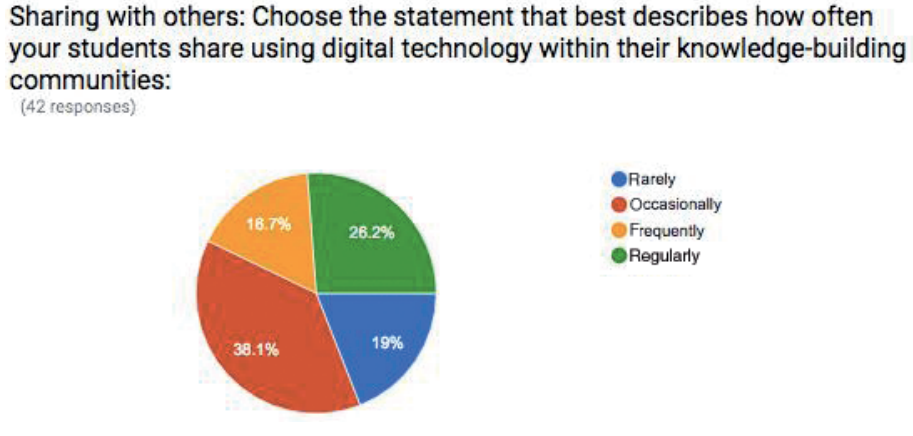

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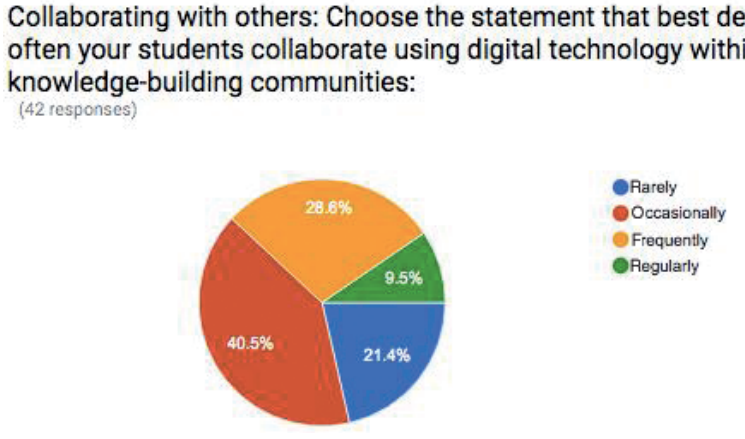
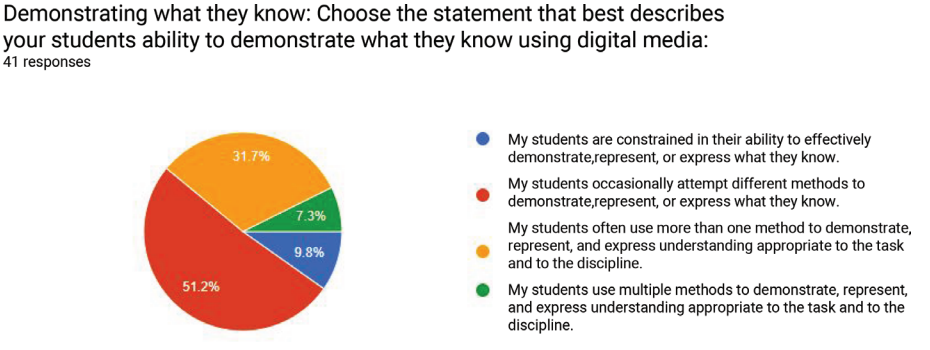
Question 6:



Question 7:



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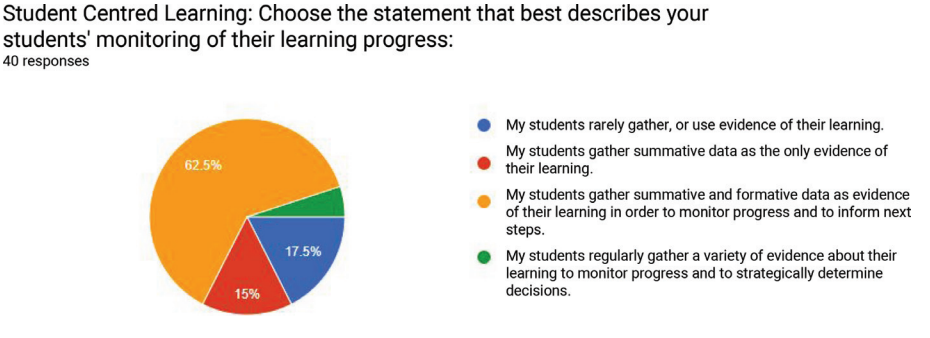
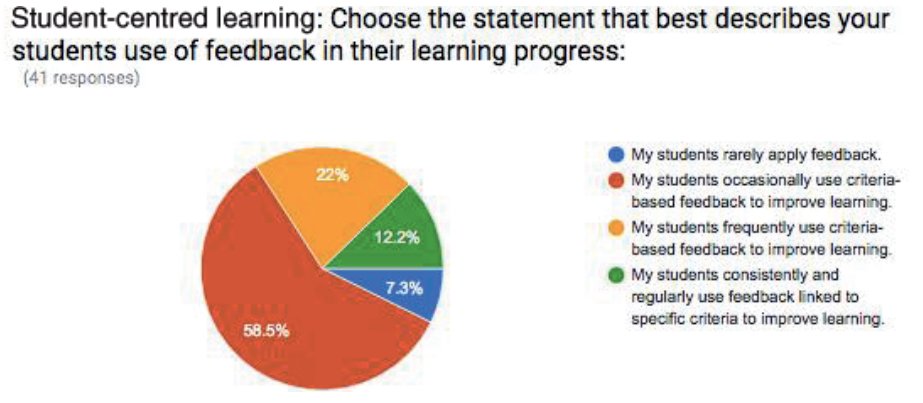
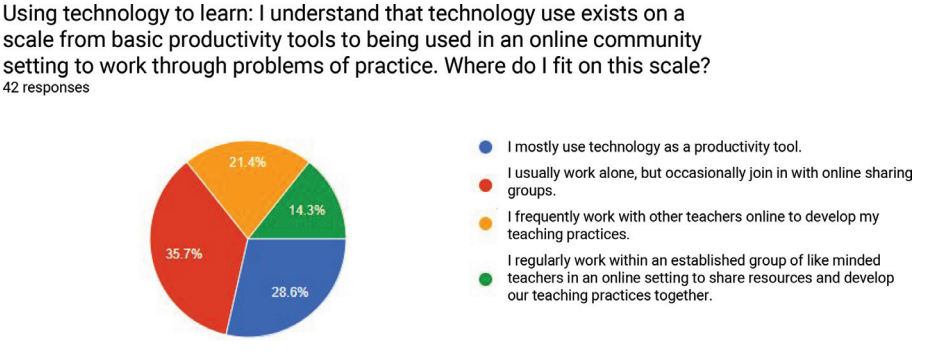


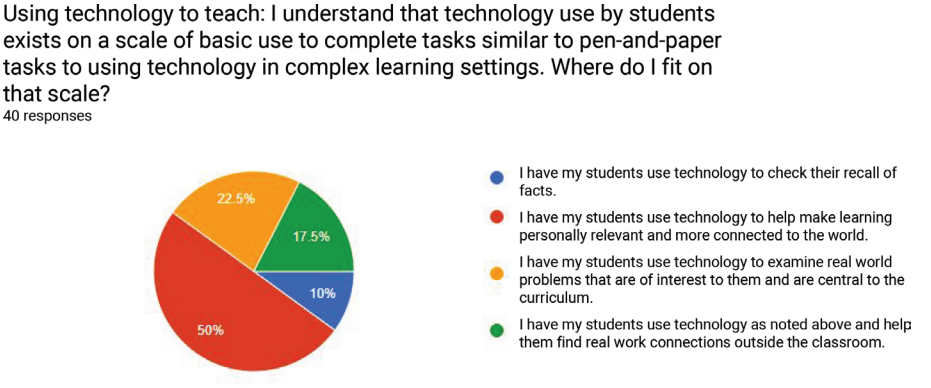
Question 9:



Question 12:



Question 13:



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