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EDUCATIONAL TECHNOLOGY DECISION-MAKING:

TECHNOLOGY ACQUISITION FOR 746,000 ONTARIO STUDENTS

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The author explores the technology procurement process in Ontario's publicly funded school districts to determine if it is aligned with relevant research, is grounded in best practices, and enhances student learning. Using a qualitative approach, 10 senior leaders (i.e., chief information officers, superintendents, etc.) were interviewed to reveal the most important factors driving technology acquisition, governance procedures, and assessment measures utilized by school districts in their implementation of educational technology. The data were transcribed and submitted to "computer-assisted NCT analysis" (Friese, 2014). The findings show that senior leaders are making acquisitions that are not aligned with current scholarship, that districts struggle to use data-driven decision-making to support the governance of educational technology spending, and that districts do not have effective assessment measures in place to determine the efficacy of a purchased technology. The study is meant to serve as an informative resource for senior leaders and to present research-based approaches to technology procurement.

Introduction

Over the last 30 years, the rapid advancement of emerging educational technologies (ed-tech) and their subsequent consumerization has led to an unprecedented shift in the K–12 education landscape (Bebell, O'Dwyer, Russell, & Hoffmann, 2010; Jenkinson, 2009). These unique teaching and learning tools have provided school districts with the opportunity to modernize their classrooms and equip their students with critical 21st century skills (Culp, Honey, & Mandinach, 2005). However, the whirlwind speed of technological development and its resulting impact on educational organizations' policies, structures, and processes has created a

critical need for effective technology management and leadership (Bellamy, 2007). The responsibilities of educational leaders and policy makers are further problematized by the collective weakness of educational technology research and its inability to provide substantial empirical evidence to support technology integration as a means of improving student learning (Bebell et al., 2010; Jenkinson, 2009). Notwithstanding these profound challenges, Ontario's publicly funded school districts have made multimillion-dollar investments in educational technology, with spending showing no signs of slowing (Ministry of Education, Ontario, 2014).

It is important to note that while Ontario's publicly funded school districts are spending large amounts of money on technology, they are doing so with minimal guidance from the province. Recently the Ontario Public School Boards' Association (2013) voiced their frustration with the province's lack of technology leadership and formal direction:

> Many other jurisdictions have moved vigorously ahead to define a vision to guide education well into the 21st century and we urge Ontario, which is a leader in student achievement and in education in so many spheres, to take up this challenge. . . . This is a matter of public confidence in our education system. Students, teachers, parents, school boards—all our education stakeholders—are ready to embrace this vision. (p. 1)

This research acknowledges the frustrations of these Ontario school leaders and seeks to determine if the technology procurement process in Ontario's publicly funded school districts is aligned with the relevant research, is grounded in best practices, and enhances student learning.

The study examines the procurement, governance, assessment, and return on investment (ROI) measures utilized by school districts in their implementation of educational technology. The following question provided the overall direction for the research study:

- How do Ontario's publicly funded school districts make decisions on acquiring new technology for their school systems?

While school boards are making increased efforts to engage their stakeholders as compared to years past, taxpayers are still largely in the dark in relation to technology acquisition. In order to address this gap in knowledge, the following questions guided this investigation:

- What are the most important factors senior leaders consider when procuring educational technology? Is this supported by relevant research?
- What are the governance procedures for technology procurement and spending? Is this guided/supported by data-driven decision-making?
- What kinds of assessment measures are in place to decide on the effectiveness of a technology and its impact on student learning? How do school districts measure and report on the return on this type of investment?

To answer these questions, the researcher compares and contrasts the reasons districts purchase technology against its theoretical framework that emerged from a review of the literature.

Literature Review

This section will explore the most important facets of technology decision-making in education. To gain a better understanding of the emerging issues, challenges, and opportunities for educational leaders today, the author begins with an in-depth examination of the foundational literature used in this study. This will provide the reader with an understanding of what the key authors and bodies of research posit about educational technology acquisition.

Conceptual and Theoretical Frameworks

As Creswell (2013) clearly states, "We conduct qualitative research because we want to understand the contexts or settings in which participants in a study address a problem or issue" (p. 40). With stakeholders in mind, it was important that the conceptual framework for this study was designed to break down the key elements of effective senior-level technology decision-

making. Consequently, the conceptual framework was developed by consulting both academic and professional literature. The following areas of exploration were identified:

1. technology procurement and spending
2. academic impact of technology on student learning
3. data-driven decision-making (DDDM)

With educational technology decision-making being such a large and complex issue (still evolving), it proved very difficult to find a single theory that encompassed all of the relevant concerns and topics related to this field of study. Of growing interest is the literature surrounding the essential conditions to support technology implementation (Gomes, 2011; International Society for Technology in Education [ISTE], 2009; Krueger, 2013), the factors that affect student learning (Finkel, 2012; Marzano, Pickering, & Pollock, 2001; McCombs & Whisler, 1997), and data-driven decision-making (Ikemoto & Marsh, 2007; Mandinach, Honey & Light, 2006).

Technology Procurement and Spending

Total cost of ownership. This framework (TCO) draws on the work of Krueger (2013) and Greaves and Hayes (2008) and highlights the need for senior leaders to be cognizant of total cost of ownership when they go to market. Krueger writes, "To get started, you must understand the cost of a technology initiative over the life of the project. . . . Initial purchases, training, and implementation costs must be amortized or annualized, and ongoing costs must be added in" (p. 26).

Organizational vision. The literature draws attention to an overall district vision as imperative for sound technology decision-making and leadership (Fullan, 2013; Gomes, 2011;

ISTE, 2009). If a technology does not fit within the broader vision and goals of the school board, then it should not be purchased. Furthermore, the overall organizational vision should be informed by the *entire* organization (ISTE, 2009).

Efficacious funding. In order for school districts to avoid implementation failures, they need to determine whether the amount of funding they have (and will have in the future) is enough to successfully purchase, deploy, and assess a new technology (Greaves & Hayes, 2008; Sundeen & Sundeen, 2013).

Academic Impact of Technology on Student Learning

Teacher training. For any technology implementation to have a high rate of success, the role of the teacher needs to be constantly considered (Avidov-Ungar & Eshet-Alkakay, 2011). In particular, professional learning and development for educators is universally identified in the literature as an essential condition for successful technology procurement and implementation (Culp et al., 2005; Greaves & Hayes, 2008; ISTE, 2009).

Increased student engagement. According to Finkel (2012), aside from standardized test scores, student engagement is the biggest measurement districts are currently using to assess the academic ROI on a technology purchase. This claim is aligned with both the American Psychological Association's (APA Work Group of the Board of Educational Affairs,1997) learner-centered framework and Marzano et al.'s (2001) nine categories of instructional strategies that affect student achievement.

Collaboration. Implementing technology in classrooms can facilitate collaboration in a number of ways that would have otherwise not been possible. Once again both the APA's (1997) learner-centered framework (*social influences on learning*) and Marzano et al.'s (2001) nine

categories of instructional strategies that affect student achievement (*cooperative learning*) mention learning through collaboration.

Data-Driven Decision-Making

Timeliness. In their analyses of data-driven decision making, Ikemoto and Marsh (2007) found that "individuals in many districts . . . commonly complained that state test data were not timely" (p. 120). With the Internet and technological tools providing students with real-time feedback in their personal lives (e.g., video games, text messaging, etc.), teachers and administrators need to be given the tools to deliver the same feedback in classrooms (Mandinach et al., 2006).

Accessibility. Along with providing timely feedback, data tools need to be accessible to relevant stakeholders. Mandinach et al. (2006) define accessibility as "how easy the tool is to access and use" (p. 10). Similarly, Ikemoto and Marsh (2007) found that if the access to data is not easy, it will not be utilized.

Capacity. While a school board's IT department has access to a variety of student data (e.g., login statistics, academic records, etc.) and can analyze the data to inform decision-making, teachers and administrators lack that ability. In order for *quality* data collection to occur, districts need to either pursue technologies that *build* the district's technical capacity to analyze/use data in their decision-making or ensure that personnel are being put in place to analyze the data emerging from classroom technologies (i.e., *data coach*; Ikemoto & Marsh, 2007).

Theoretical Framework of Technology Decision-Making

Based on the literature review of existing research on technology decision-making, a research model has been developed that is aligned with the study's conceptual framework. The research model is used as a basic expectation of senior leaders who are making technology decisions at the district level (see Figure 1).

Research Design and Methodology

The aim of this research was to explore the decision-making process behind technology procurement in Ontario's publicly funded school districts. This study employed a qualitative case study approach using both face-to-face and online interviews, which allowed the participants in the study to describe their experiences in context, so that the research community and stakeholders are better positioned to understand their actions (Robottom & Hart, 1993). Although educational technology research is dominated by qualitative studies (Bebell et al., 2010), technology spending, its academic impact, and data-driven decision-making have not been studied in combination to determine how senior leaders make educational technology decisions.

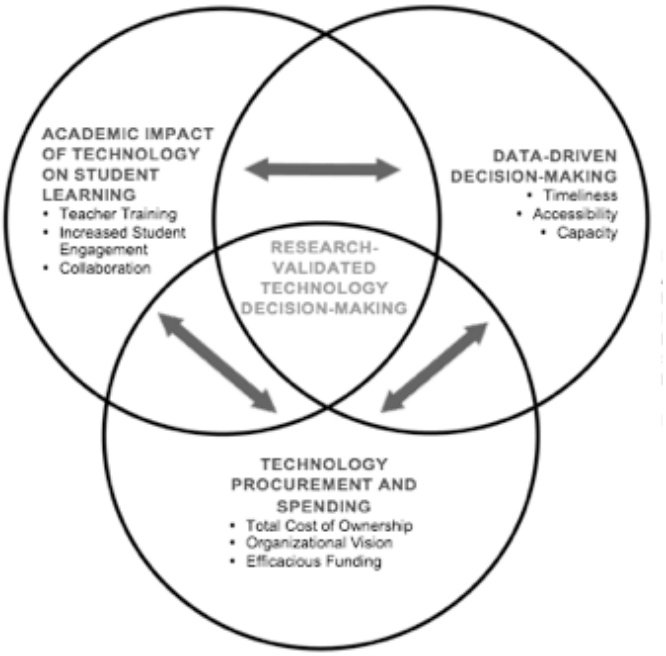

Figure 1. Theoretical Framework of Technology Decision-Making.

Selection of Participants

Participants were selected using purposeful sampling in which, as Creswell (2013) writes, "the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study" (p. 156). Therefore, it was important to select individuals who are in leadership positions and make high-level decisions regarding school technology acquisitions, assessments, and analyses. These individuals typically hold the title of chief information officer" (CIO) or superintendent and possess the status, experience, and knowledge required for this study. It was decided that the study would need at least 10 senior leaders to participate for the findings to be impactful and once the tenth interview had been scheduled the researcher no longer accepted participation requests.

Instrumentation

For the exploration of the central phenomenon of this study, a semistructured interview design with mostly open-ended question was deemed appropriate. The questions were developed based on the Theoretical Framework of Technology Decision-Making, the research questions, and current technology trends/topics that were emerging in both professional and general discourse. The researcher conducted the interviews over a four-month period and then subsequently transcribed the audio recordings. Validation was sought from participants through a member check as well (Creswell, 2013; Tracy, 2010).

Data Processing and Analysis

The analytic approach that was used in this research study is "computer-assisted NCT analysis" (Friese, 2014) using ATLAS.ti, a computer-aided qualitative data analysis software (CAQDAS). Computer-assisted NCT analysis is adapted from Seidel (1998) and is comprised of three basic components, which are *noticing* things, *collecting* things, and *thinking* about things. These three basic elements are common to a large range of analytical practices in qualitative research and Creswell's (2013) five research traditions in particular.

The first phase of the NCT method required the researcher to notice interesting things in the data and write down notes or attach preliminary codes. The second phase involved the researcher collecting similar items under existing, new, or merged code labels. Although NCT analysis does not prescribe any particular way of coding, the researcher of this study employed the use of both deductively and inductively developed codes (Friese, 2014). The final phase engaged the researcher in deeper thinking after coding to discover patterns and processes across the cases. Additionally, participant responses were tallied and summed for particular questions

based on frequency of mention. It was important to use the NCT method in this research study in order to use the *full* functionality of ATLAS.ti in analyzing the data (e.g., Phase 2 of the NCT method is best accomplished through the use of ATLAS.ti's code co-occurrence table tool).

Findings

The 10 participants were senior-level decision-makers who currently hold leadership positions in publicly funded school districts in Ontario. They are identified by the pseudonyms of Amanda, Anthony, Clive, Daniel, Gabriela, Julia, Megan, Nicholas, Stan, and Walter. Table 1 provides a description of each senior leader and his or her respective school district.

Most Important Factors Driving Technology Acquisition

The data revealed that the 10 senior leaders considered many of the same factors when acquiring technology for their school districts. In discussing the process, they all acknowledged numerous challenges in determining what technologies to purchase for their stakeholders. During the interviews, participants were asked to *identify* and *rank* the most important factors they consider when procuring technology for their school districts. In reviewing the data, the most common response (in terms of frequency) was (1) cost-related factors, which was mentioned by all 10 senior leaders. Next, (2) impact on school board infrastructure was considered by nine of the participants. Seven senior leaders deliberated (3) product specifications, and four measured a product's (4) alignment with technology plan/organizational vision. Finally, three participants considered (5) the impact of technology on instruction and student learning when purchasing hardware/software. Table 2 shows the participants' responses.

Table 1

Description of Senior Leaders and Their School Districts

Pseudonym	Position	Main responsibilities	No. of students	No. of teachers	No. of schools	Size
Amanda	Superintendent	Academic	Under 50,000	Under 3,000	50 to 100	Medium
Anthony	Superintendent	Academic	50,000 to 100,000	3,000 to 6,000	100 to 200	Large
Clive	/	Nonacademic	Above 100,000	Above 6,000	Above 200	Very large
Daniel	Superintendent	Academic	Above 100,000	Above 6,000	Above 200	Very large
Gabriela	/	Academic	50,000 to 100,000	Above 6,000	100 to 200	Large
Julia	Superintendent	Nonacademic	Under 50,000	Under 3,000	50 to 100	Medium
Megan	CIO	Nonacademic	Under 50,000	Under 3,000	50 to 100	Medium
Nicholas	CIO	Nonacademic	50,000 to 100,000	3,000 to 6,000	100 to 200	Large
Stan	CIO	Nonacademic	50,000 to 100,000	Above 6,000	100 to 200	Large
Walter	CIO	Nonacademic	Under 50,000	Under 3,000	50 to 100	Medium

Note. Clive and Gabriela's position titles were purposely not disclosed because revealing them could potentially identify them to readers.

Cost-Related Factors

All 10 participants stressed the importance of various cost-related factors when considering purchasing new technology resources for their school districts. Nine participants emphasized (a) affordability/price, seven discussed (b) sustainability, and two mentioned (c) cost-saving potential.

Affordability/price. Participants provided several examples where high prices were a prominent factor and deterred their organizations from procuring certain software/hardware.

> Cost is really important and sometimes cost will put things out of our reach. So a one-to-one (1:1) project would be out of our reach because sheer cost would put it out of reach. (Amanda)

Sustainability. Seven school leaders reported that the sustainability of a new technology needed to be considered before it is purchased.

> So affordability and sustainability are absolutely key. As you are probably aware, we recognize that the cost of acquisition is often just the smallest component of overall technology costs. (Megan)

Cost-saving potential. Participants were asked if they were more prone to want to acquire cheap or free technology/technological tools. The wariness that cheap/free technology would not actually save the organization money in the long term figured very heavily in participants' responses. In fact, the majority of participants did not consider the resources "free" at all.

> Free is not necessarily "free." I can get free software and then I pay for all the support, and all the training, and all of the maintenance, and all of the upgrades. I could pay for something upfront and the company pays for the maintenance, the support, and the upgrades. Your call. (Gabriela)

Impact on School Board Infrastructure

Of almost equal importance to cost-related factors was the impact a new technology would have on the school board's infrastructure. Five participants emphasized (a) access/mobility and four discussed (b) compatibility with the existing network.

Access and mobility. Several participants described their current focus on providing *all* stakeholders with access to resources and core services through devices. The most common way to do this was through increasing the district's Wi-Fi presence to allow stakeholders the ability to access online content.

> After deciding that we significantly needed the infrastructure, we then bought routers, switches, and wireless technology in an effort to provide an environment that was ready for ubiquitous access. (Stan)

Table 2

Most Important Factors Driving Technology Acquisition

Amanda	Anthony	Clive	Daniel	Gabriela	Julia	Megan	Nicholas	Stan	Walter
Compatibility with existing network (1)	Accessibility (1)	Affordability/ price	Needs of the organization (1)	Technology plan	Functionality (1)	Affordability/ Price (1)	Technology plan (1)	Technology plan/ organizational goals	Compatibility with existing network (1a)
Affordability/ price (2)	Sustainability	Sustainability	Organizational goals	Access/ mobility	Best allocation of resources (2)	Sustainability (2)	Professional development	Access/ mobility	Cost-saving potential (1b)
Functionality (3)	Technology plan	Compatibility with existing network	Professional development	Pedagogy	Affordability/ price		Sustainability	Infrastructure	Industry research (2)
Mobility (4)	Pedagogy	Access/ mobility	Affordability/ price	Compatibility with existing network	Cost-saving potential		Infrastructure	Affordability/ price	Sustainability
Assistive features (5)			Durability	Assistive features	Durability		Affordability/ price	Sustainability	Affordability/ price
End user feedback (6)				Affordability/ price	Supportability		Functionality		Durability
				Sustainability	Manageability		Durability		Assistive features
					Access/ mobility		Student learning		

Note. Some participants were able to rank the factors in terms of their importance. The rankings are reflected in parenthesized numbers.

Compatibility with the existing network. Four of the participants acknowledged that compatibility with their organization's existing network (i.e., wireless infrastructure, human resources, etc.) was very important and minimized the amount of changes that would occur during implementation.

> Compatibility with our existing network is a huge, huge factor. Probably number one . . . that it would fit in with our existing technology, our existing infrastructure and not involve large changes. (Amanda)

Product Specifications

In comparison to the previous two factors, product specifications were less apparent in the data when senior leaders described technology acquisition. However, seven participants did state that one of the important considerations they make in the purchasing process surrounds what the product *does* and whether it meets the criteria of the organization. Specifically, five senior leaders identified (a) durability, three mentioned (b1) functionality, and three named (b2) assistive features as key specifications they evaluate when acquiring technology.

Durability. Five senior leaders accounted for the importance of durability up front. Walter explained that purchasing a product that is known to be durable might require his district to pay a slight premium for that technology. He went on to speak about how a difference of a few thousand dollars between competing technologies could mark the difference between one product failure over 8 years and 2,500 failures.

Functionality. Three participants expressed that functionality was a key factor they assessed when acquiring new technology. Julia highlighted the importance of functionality from the very beginning of the interview.

> So probably the single most important factor when you are making these decisions is "Does the actual delivered functionality meet the requirement?" . . . Really we look at it pretty dispassionately. (Julia)

Assistive features. Three participants expressed that assistive features were key capabilities they looked for in the products they evaluated. Walter provided an example of how his district managed to address the needs of special education students in the procurement process. He described that if he were looking to acquire 1,000 laptops he would automatically ensure that 3% (or 30 units) came with a larger display and touch screen functionalities to accommodate those students with visual impairments.

Alignment With Technology Plan/Organizational Vision

Five participants made reference to overarching (formal) documents that were actively guiding their current and future technology acquisitions. Four participants reported that their districts had technology plans that had been developed internally, while one participant's organization had adopted an external technology standard. Gabriela outlined her efforts in writing and publishing a technology plan that was well received throughout the district.

> The current iteration of things is I wrote and published a technology plan amidst the district 3 years ago. We just finished year two of it. It is a 5-year plan and the plan is on our website and it is all about going mobile and in a culture of accessing mobility. (Gabriela)

However, even with a very clearly laid out technology plans, Stan and Megan both outlined that in such large organizations there were going to be stakeholders that deviated from the vision.

> So of course with [several hundred] schools we are going to have the "renegades," for lack of a better term, who want to go out and try something different and new. (Stan)

While Stan's department responds by evaluating the situation more closely and by advising the administrator of the potential risks and challenges ahead, Megan was less optimistic about getting the staff in her school district to understand the proposed vision.

> Because we have a problem where I would say . . . the majority of the system does not care what the [technology plan] says. They have their own vision of how technology should be used and what technology they need. (Megan)

Impact of Technology on Instruction and Student Learning

Student learning was discussed in all of the senior leader interviews. However, only three participants mentioned its prominent role in the acquisition of a new technology. Two senior leaders placed emphasis upon the technology's ability to improve (a) pedagogy and one considered (b) student learning in their organizations when evaluating a potential acquisition.

Pedagogy. In addition to other factors they previously mentioned, Gabriela and Anthony focused on supporting the needs of their teachers so that instruction throughout their school boards could be both improved and adequately supported.

> We do not go out and buy gear because it is the "equipment du jour." We go to meet the pedagogical needs of the teacher . . . to meet the pedagogical needs is the primary piece in there. (Gabriela)

> Pedagogy is first. You can put in all of the technology in the world but if the type of instruction or strategies being used by teachers is not effective, it does not matter what the technology is. (Anthony)

Student learning. Nicholas outlined how his district sought to improve student learning through technology. For him the ISTE standards his organization adopted give his department solid criteria from which to assess potential acquisitions. He mentioned that since the province of Ontario lacked a central curriculum or mandate around student learning and technology, the board found guidance through ISTE.

> And they have what they call the "ISTE Strands." Six strands that, again, I don't know if you have seen them . . . but they deal with how to use technology for learning. So we saw a perfect fit with ISTE on how to integrate technology into learning. (Nicholas)

Governance and Data Support

One of the aims of this research study was to identify the governance procedures for technology procurement and spending in publicly funded school districts. Analysis of the interview data uncovered that policy, committees, and senior district leadership play important roles in the governance models used to support technology acquisition. Moreover, it was determined that while senior leaders and their districts are making varied (and inconsistent) uses of data in their organizations, most struggled to use data in meaningful ways (i.e., to support spending, to make in-class decisions, and so on).

Policy

Nine participants acknowledged their obligation to abide by their district's (a) internal purchasing policies, while only five referenced the province's (b) Broader Public Sector (BPS) Procurement Directive.

Internal purchasing policies. Most of the participants recognized the importance of having/creating internal purchasing policies that outlined *their* expectations during the acquisition process. It should be noted that the school board purchasing policies most senior leaders described were not specific to technology and often extended to all board acquisitions (e.g., furniture, equipment, etc.).

> We have got to go through a process of getting competitive quotes. So it is fairly rigorous from the technology standpoint but also from the purchasing standpoint that would apply to whether we are talking about technology or buying garbage bags. (Megan)

Broader Public Sector Procurement Directive. Five participants described the importance of ensuring the acquisition process follows the guidelines set out by the government

of Ontario. Clive described how the main reason his organization respects the formality of the directive is because of the auditing process they undergo each year.

> Anything that we buy has to fit into that Broader Public Sector Procurement Guidelines. The reason for that is also we do get audited every year. . . . All the POs are cut and everyone else has looked at it. "How was this approved? Who approved it?" (Clive)

Committees

The data showed that anywhere from one to four different committees could be involved in a single acquisition. In most cases the committees featured representation from both academic and business stakeholders. Eight participants referred to (a) the role of teachers, six mentioned (b) the role of academic consultants, and five spoke about (c) the role of IT as central components of the procurement process.

Role of teachers. Four participants described *formal* programs/roles their school districts had created to engage teachers in the use, purchase, and evaluation of the technology being brought into the classroom. In contrast, four other participants reported *informal* ways teachers were driving technology decision-making. Clive outlined that his board methodically selected 60 teachers (from both elementary and secondary schools) to hold leadership positions related to digital learning. These teachers maintained their full-time role in the classroom but were also called upon to run pilots, give feedback, and engage with the district at committee meetings. In contrast, Daniel and Stan reported that their teachers were supporting 21st century learning on their own. However, Megan expressed that some teachers and schools had become very resistant to integrating technology and that this took away from the overall goal of improving student learning.

> It really at some points becomes debilitating because people are losing sight of the goal. They are losing sight of the direction because they all come from their respective camps and that is what they want to achieve. (Megan)

Role of academic consultants. Six senior leaders made reference to the role of their district's academic consultants. Most of these individuals were former teachers or administrators who were highly involved in evaluating the technologies being considered for purchase, training teachers, and gathering feedback/research on technology use in the classroom.

> So we have those folks that are responsible to be the bridge or the glue between the technology and the pedagogy. (Walter)

Role of IT. Five participants stressed the significance of involving the district's IT technicians in the acquisition of a new technology. For many years, IT staff operated under the same guidelines day in and day out, and the acquisition of hardware/software was their responsibility *alone*. Today, most senior leaders communicated that the IT staff does not have this same level of control any longer.

> That is the shift where IT departments are no longer calling the shots. We are facilitating kids' learning and teachers' learning. And I think that has happened and I have seen it unfold in front of my eyes over the last six years or so. (Gabriela)

Senior District Leadership

In talking with participants about their school district's budget, all 10 revealed that no other group had as much control as the board of trustees. As publicly elected officials, their role is to ensure that taxpayer dollars are being spent wisely and that the formal policies in place are in support of improved student achievement (i.e., higher report card grades, improved standardized test scores, and so on). Stan emphasized that, although his district's trustees are ultimately focused on the dollars being spent, they also weigh in on programming decisions.

> More so we focus with our trustees, definitely on dollars, absolutely . . . but we also focus a lot with them on program and the integration of technology

> and program. . . . They are as interested in the dollars and cents as they are in the effect it has on students. (Stan)

In contrast, three participants expressed that the trustees in their boards were not involved in the selection of devices. Their departments alone were able to make the call as to what technologies they were going to pursue.

> But the daily acquisitions, like choosing the tablet, the trustees did not have any influence on what tablet we went with or what laptops we chose to go to as an enhancement in schools. . . . (Anthony)

Data Support

The participants were asked if they employed the use of data-driven decision-making, or DDDM, to support their acquisition decisions. Most senior leaders claimed that their organizations were data driven but had difficulty explaining what types of data they were using to support their procurement of technology. Furthermore, three participants highlighted numerous challenges associated with conducting data analysis and its overall use in the decision-making process. According to the frequency in the interviews, three senior leaders discussed DDDM as a means (a) to drive organizational efficiency and two mentioned its ability (b) to drive student achievement.

Driving organizational efficiency. Walter, Megan, and Clive all provided examples of data's role in the business operations of their school districts. The level of expertise/knowledge they communicated on the subject was impressive. Clive provided an example of the impact DDDM can have on a large-size organization and the astounding potential for cost saving.

> Last year we had 26,000 calls come into our help desk for password resets and that is almost like 10% of the calls. . . . Each password reset is costing me $5 so that is almost $130,000 being spent on that. Can I now do something so I can lower my cost there? Now money and resources are free to do something else. (Clive)

Driving student achievement. The data revealed that Education Quality and Accountability Office (EQAO) scores were the most common data set being used by senior leaders to justify or tailor technology acquisitions (and the resulting rollout). Stan admitted that his board did not have a good grasp on the big data movement and questioned whether they had the capacity as an organization to take advantage of incorporating DDDM in the near future.

> My concern is that we can become completely bogged down in data and not look at what is right in front of us. . . . I think there are cases where it is obvious that the data is clear enough that you need to make this type of change. . . . Students want to bring their own device, so let them bring their own device. (Stan)

Assessment and Return on Investment Measures

Another aim of this research study was to determine what kinds of assessment and return on investment or ROI measures districts used to decide on the effectiveness of a technology and its impact on student learning. The 10 senior leaders made reference to a number of different testing methods they employed after acquiring a new technology. Data analysis revealed that school boards had more success conducting technical assessments on hardware/software than academic assessments of the technology's impact in the classroom (where they had great difficulty). Furthermore, when asked how they reported the return on technology investments within their district, none had a formal process in place to justify their spending.

Technical Assessments

Seven senior leaders referred to the technical assessments they use throughout their school districts to ensure the technologies they have purchased are functioning properly and are being used by stakeholders. Much of the participant responses surrounded the measuring of

device usage (i.e., login statistics). Amanda found that the technical assessments her team carried out were relatively straightforward.

> So on the tech side of it, it is really pretty simple because we can see uptake of use. . . . We use our help desk system because we can see the certain kinds of breakdowns, certain products we will not use anymore, those sorts of things. (Amanda)

Academic Assessments

All 10 participants expressed that their districts were experiencing difficulties in conducting high-quality academic assessments that evaluated technology's impact on their students' learning. The assessments they currently used were largely anecdotal in nature. Most of the participants' responses highlighted "pre" and "post" evaluations of student engagement measures (i.e., increased levels of attendance) during pilot studies. Stan described the difficulties in establishing reliable metrics to measure the academic value of the technologies they were acquiring.

> The majority of the data is anecdotal. No doubt about it. It is really tough to measure and it is a question we get all the time. (Stan)

Given the difficulties they were having in establishing reliable metrics around technology and student achievement, many senior leaders opted to consult EQAO scores. However, most participants reported that they did not play a large role in the acquisition of a new technology; it was simply one of the only metrics they had available.

Return on Investment

Participants were asked how they reported the return on educational technology investments within their school districts and communities. While many senior leaders reported back to the board of trustees to update them on the progress of various technology deployments,

none had a formal ROI process in place. Once again *softer* reports with limited data were used to justify their technology acquisitions. Nicholas expressed the immense difficulty in being able to conduct an accurate ROI analysis in his school district.

> How do you quantify it right? . . . So as we have said there are not a lot of ROI tools. . . . How do I know anything is improving instruction? Whether it is improved lighting or air conditioning. (Nicholas)

Anthony described the disparity between the ROI measurements his department valued and the values of the board of trustees in his district.

> From a board of trustees' perception, it is graduation rates and EQAO. Although we talked about knowing your students, knowing them at such an intimate level, their learning needs, that is not what gets shared in the boardroom. (Anthony)

Discussion

The findings revealed that *cost-related factors* are the most important concerns senior leaders have when acquiring a new technology for their school district. While the importance of financial considerations is echoed throughout the literature (Greaves & Hayes, 2008), they should not be *driving* technology acquisition. This finding also echoes the results of Morrison, Ross, Corcoran, and Reid's (2014) recent study of ed-tech purchasing in the United States. They write, "The most frequent challenge expressed in open-ended survey responses, and most strongly emphasized by superintendents, related to funding and financial concerns" (p. 5).

The finding that *product specifications* weigh heavily in participants' acquisition decisions is not explicitly noted in the literature. When describing the most costly mistakes associated with technology procurement, Greaves and Hayes (2008) and Krueger (2013) cite hardware and software problems as one of the most frequent occurrences in American school districts. The participating school leaders seemed to recognize this and are taking proactive

measures to ensure they are receiving the best financial return on their purchases. However, this heavy focus on product specifications only further extends the notion that district leaders are squandering opportunities to make real connections between technology and learning.

A few participants recognized the importance of their district's *technology plan/organizational vision*. However, none noted that the overall vision had been informed by the *entire* organization. ISTE (2009) implores senior leaders to utilize, "proactive leadership in developing a shared vision for educational technology among all education stakeholders, including teachers and support staff, school and district administrators, teacher educators, students, parents, and the community" (para. 1). Perhaps the absence of this meaningful engagement is why some leaders are having difficulty getting their stakeholders to buy into their technology plans/policies.

An emphasis and focus on technology's *impact on instruction and student learning* during acquisition is strikingly limited in the data collected from senior leaders. This is highly inconsistent with the current literature on supporting student learning through technology and this study's conceptual framework. Without a focus on pedagogy and student learning, school leaders and their districts risk being exposed to numerous challenges (Fullan, 2013).

The findings revealed that *committees* also largely contributed to the governance of educational technology acquisition and implementation in the participating school districts. It was apparent that all of the districts are in a significant period of transition and have recently undergone changes to better address the technology needs in their organization. This is consistent with recent research emerging from Ontario. Clarke et al. (2014) write:

> School districts are investigating and implementing new organizational structures that embed coordinated approaches to using technology. They are in the early stages of aligning departments and jurisdictional responsibilities

> to enable system-wide approaches to 21st century teaching and learning (e.g., establishing working relationships between IT and curriculum). (p. 19)

While most of the senior leaders mentioned the key roles teachers play on certain committees or in the rollout/implementation process, only one discussed their direct involvement in the acquisition of a new technology. As mentioned previously, this contradicts the reviewed literature that says if teachers are given a greater voice in the decision-making process, the success rate of the technology implementation greatly increases (Bill and Melinda Gates Foundation, 2014).

It is important to note that, in the absence of effective academic assessment measure, some districts are using EQAO scores when making technology-related decisions. This practice directly contradicts the reviewed literature that stresses standardized tests only measure fact recall and broad knowledge in students and are largely unrelated to the development/measurement of 21st century skills (Bebell et al., 2010). Perhaps the role of EQAO test results in Ontario education needs to be revisited.

Finally, the finding that participating school districts had no formal ROI process in place is consistent with very recent research on technology acquisition and reinforces the notion that districts need to shift their focus to analyzing technology's impact on student learning. Krueger (2013) advocates for a redefinition of return on investment that focuses less on cost-related factors and more on student learning and community-building (i.e., developing 21st century skills, engaging parents, etc.).

Implications

The author demonstrated that when compared and contrasted against the study's Theoretical Framework of Technology Decision-Making (refer back to Figure 1), senior leaders

are not making decisions that are aligned with formal research, grounded in best practices, and in enhancement of student learning. It has become increasingly clear that districts lack guidance when purchasing technology. However, it is the author's stance that using relevant scholarship as one's *strategy* during technology decision-making can help districts avoid missed opportunities and costly mistakes. The framework was renamed the Strategic Model for Technology Acquisition (Figure 2) and gives districts the opportunity to ensure that each decision they make is aligned with the key theories and body of research. For the purposes of this framework the areas were renamed strategic academic assessment (TIC), strategic data use *(*TAC), and strategic acquisition (TOE).

While the results of this study produced similar results to the recent studies conducted on educational technology procurement in school districts in the United States, the Canadian context should be further explored. Little research has been discovered on educational technology acquisition in Canada, and this study should be accompanied by investigations into other related areas. One cannot assume similarities between the U.S. and Canadian education systems based on the results of this research.

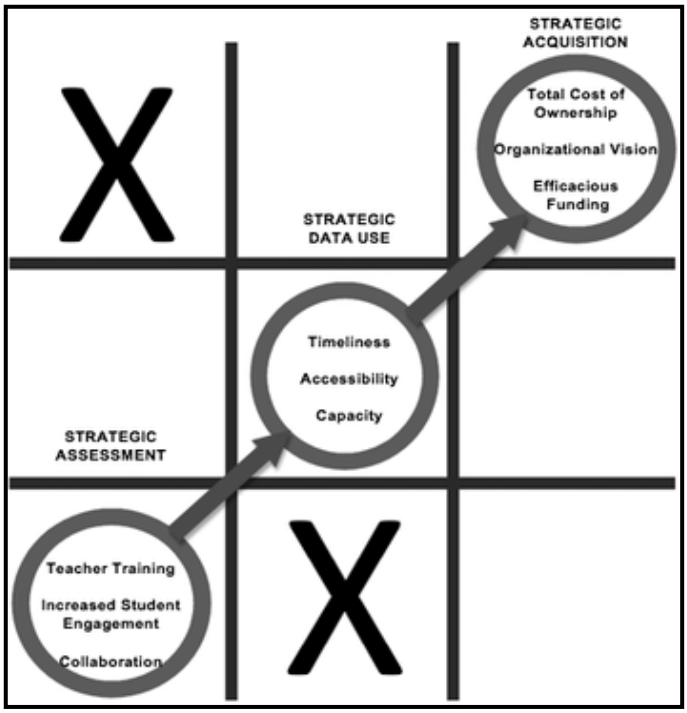

Figure 2. Strategic Model for Technology Acquisition.

Conclusion

While it may seem that districts are encountering numerous challenges in several key areas of educational technology procurement, there is one area in which they excel: purchasing. From durability to sustainability, affordability to cost-saving, district leaders are going above and beyond to ensure they are receiving the best deal possible from vendors. So what is the problem? The issue lies with the fact that school leaders have become so focused on not integrating technology for technology's sake, that they are ignoring/undervaluing the pedagogy and the product's impact on student learning. This is misguided and highly dangerous when you consider the price districts in the United States have had to pay for taking the same approach (i.e., poor usage rates, millions of dollars wasted, and so on).

The researcher implores Ontario's Ministry of Education to take greater leadership in the area of technology acquisition. With districts feeling pressured by stakeholders to quickly get technology into their classrooms and the competition for provincial funding growing steadily, the roles and responsibilities of senior leaders are becoming increasingly complicated. The challenges highlighted in this study are not isolated but systemic and need to be quickly remedied. One potential solution lies in the Ministry of Education, which can provide the support and guidance needed to implement meaningful education reform in Ontario. The rapid pace at which technology is advancing is certainly not helping their case. Yet while the province is right in its reluctance to chase technology for its school systems, it should instead be sprinting towards establishing best practices and leveraging personalized learning opportunities for its students. After 15 years in the 21st century Ontario has been sluggish in that regard. In order to create an education system rich in pedagogy and empowered by 21st century technologies, provincial leadership needs to better support its school district leaders.

References

APA Work Group of the Board of Educational Affairs. (1997, November). *Learner-centered psychological principles: A framework for school reform and redesign*. Washington, DC: American Psychological Association.

Avidov-Ungar, O., & Eshet-Alkakay, Y. (2011). Teachers in a world of change: Teachers' knowledge and attitudes towards the implementation of innovative technologies in schools. *Interdisciplinary Journal of E-Learning and Learning Objects*, *7*, 291–303.

Bebell, D., O'Dwyer, L. M., Russell, M., & Hoffmann, T. (2010). Concerns, considerations, and new ideas for data collection and research in educational technology studies. *Journal of Research on Technology in Education*, *43*, 29–52.

Bellamy, A. (2007). Exploring the influence of new technology planning and implementation on the perceptions of new technology effectiveness. *Journal of Technology Studies*, *33*, 32–40.

Bill and Melinda Gates Foundation. (2014). *Teachers know best: What educators want from digital instructional tools*. Retrieved from http://collegeready.gatesfoundation.org/wp-content/uploads/2015/04/Teachers-Know-Best_0.pdf

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage.

Culp, K. M., Honey, M., & Mandinach, E. (2005). A retrospective on twenty years of education technology policy. *Journal of Educational Computing Research*, *32*, 279–307.

Finkel, E. (2012). Getting the best ROI in technology: The latest, greatest tools won't buy you success without a plan. *District Administration*, *8*, 74–80.

Friese, S. (2014). *Qualitative data analysis with ATLAS.ti*. Los Angeles: Sage.

Fullan, M. (2013). *Stratosphere: Integrating technology, pedagogy, and change knowledge*. Don Mills, ON: Pearson.

Gomes, W. (2011). Leadership in educational technology: Insights from the corporate world. Journal of Leadership Studies, *4*(4), 57–61.

Greaves, T., & Hayes, J. (2008). *America's digital schools 2008: The six trends to watch*. Retrieved from Loudoun County Public Schools website http://www.lcps.org/cms/lib4/VA01000195/Centricity/Domain/52/Americas_Digital_Schools_2008.pdf

Ikemoto, G. S., & Marsh, J. A. (2007). Cutting through the "data-driven" mantra: Different conceptions of data-driven decision making. *Yearbook of the National Society for the Study of Education*, *106*, 105–131.

International Society for Technology in Education (ISTE). (2009). *Essential conditions*. Retrieved from http://www.iste.org/docs/pdfs/netsessentialconditions.pdf?sfvrsn=2

Jenkinson, J. (2009). Measuring the effectiveness of educational technology: What are we attempting to measure? Electronic Journal of e-Learning, *7*, 273–280.

Krueger, K. (2013). Forget ROI, the future of technology investment is all about value. *THE Journal*, *40*(6), 25–28.

Mandinach, E. B., Honey, M., & Light, D. (2006, April). *A theoretical framework for data-driven decision making*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Marzano, R., Pickering, D., & Pollock, J. (2001). *Classroom instruction that works*. Alexandria, VA: ASCD.

McCombs, B., & Whisler, J. S. (1997). *The learner-centered classroom and school: Strategies for increasing student motivation and achievement*. San Francisco: Jossey-Bass.

Ministry of Education, Ontario. (2014, September 4). *Technology in classrooms helping students succeed: New fund will improve access to leading-edge learning tools* [News release]. Retrieved from http://news.ontario.ca/edu/en/2014/09/technology-in-classrooms-helping-students-succeed.html

Morrison, J. R., Ross, S. M., Corcoran, R. P., & Reid, A. J. (2014). *Fostering market efficiency in K–12 ed-tech procurement*. Baltimore: Center for Research and Reform in Education, Johns Hopkins University. Retrieved from http://b.3cdn.net/dpromise/4e2869abb217c9062f_z6m6v2v9u.pdf

Ontario Public School Boards' Association. (2013). *A vision for learning and teaching in a digital age*. Retrieved from http://www.opsba.org/files/OPSBA_AVisionForLearning.pdf

Robottom, I., & Hart, P. (1993). *Research in environmental education: Engaging the debate*. Geelong, Australia: Deakin University Press.

Seidel, J. V. (1998). *Qualitative data analysis*. Retrieved from http://www.qualisresearch.com/qda_paper.htm

Sundeen, T. H., & Sundeen, D. M. (2013). Instructional technology for rural schools: Access and acquisition. *Rural Special Education Quarterly*, *32*(2), 8–14.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry*, *16*, 837–851.