

Best Practices in Implementation of Technology Change in the K-12 Context

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Abstract This is a study of a specific school board's experience with the transformation to 21st century learning and teaching via technology implementations at the school level. The study looks at successful technology implementations by analyzing interview data from school board administrators and superintendents involved in several effective school implementations. In essence, what practices and underlying philosophies are adopted by school board leadership and school administrators in the successful technology implementations in K-12 schools? The paper builds upon United States based research by examining excellence in technology implementations in schools in Canada. The implications for practice are applicable to all education organizations to create awareness of factors needed for school level change to occur.

Keywords: *technology implementations, change management in education, leadership, 21st century learning and teaching*

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1. Introduction

What is it that makes some schools more successful with implementation of technology than others? In theory, the same vision and values are established in an education organization, such as a school board. However, the outcome of projects, programs and policies often differ.

A school is a unique entity comprised of its unique student and teacher demographics. Schools are managed by unique principals, who have unique relationships with superintendents. The role of superintendents is to realize the vision of the school board across all schools. Somehow the unique dynamic of each school leads to either the adoption of change and the absorption of new projects or to the preclusion of a change from occurring. Is there anything we can learn from successful implementations that may be used in schools that have been less successful?

Change management refers to the practice of managing change at an organizational level. The management of projects, on the other hand, is done by utilization of project management methodologies, which help to plan and organize the work to be done. Change management deals with the change component that affects people (as a result of projects or changes invoked by organizations). Ideally, these two practices (project management and change management) should be intertwined within each project. Michael Beer calls this the "Strategic Fitness Process", which is a framework for leadership to use in order to develop effective organizations (and change management action plans) [4]. The Strategic Fitness Process is used in organizations to effectively manage the evolving nature of business.

With the influx of technology into society, education organizations are responding by integrating technology into the classroom to prepare the next generations, whose skill demands in the workplace will differ from those of past generations. As such, the curriculum, its mode of delivery, its delivery tools and even the set up in the classrooms are being altered.

The Ontario Ministry of Education website: www.edugains.ca is dedicated to 21st century learning and teaching and the Province of Ontario's plan to move public education into the 21st century learning and teaching practice. Canadian provinces' Ministries of Education have similar plans to attain this goal. In fact, this pressure to integrate technology through K-12 for the purpose of delivering 21st century skills is felt on an international scale.

"There is a shift in the current teaching from teacher delivery of information, toward student-directed learning. Through the use of technology students can gather, organize, and then share information. The process of learning in this model shifts from teacher delivered information to knowledge that is constructed by students themselves through experiencing the available information through the use of technology. "[34].

Workplace changes often evoke resistance and are critiqued by staff who usually bear responsibility for the core of the change. In the case of education transformation toward adoption of 21st century learning and teaching, teachers are the critical stakeholders. What emerging practices are proving positive to implement this change? I am interested in finding out what methods work best to 'get people on board' to implement technology programs, projects and policies in an educational setting. In particular, I am interested in learning more about how

school board administration and superintendents implement these changes, particularly in schools that are leaders in adoption of technology in their classrooms. How do these administrators and education leaders facilitate an adoption of change? What techniques of leadership do they use? How do their actions correspond to comparable research findings?

In order to narrow the focus to a more measurable and currently relevant example, I will study the technology implementations at a single school board. The focus will be on examples of excellence in schools that have implemented technology successfully. Through qualitative, interview-based research, I will be using the findings of recent research studies of technology implementations in a K-12 setting in order to learn more about the philosophies, practices and elements of successful technology implementation. The interviews will build on research findings from comparable studies conducted in United States based schools, in order to expand on the findings and validate them in the Canadian context. The core question in this study is, what practices and underlying philosophies are adopted by school board leadership and school administrators in the successful implementations of technology-based, 21st Century learning and teaching programs and policies?

The question is worth addressing firstly because change is often resisted in a workplace. For this very reason, organizations should know how to elicit optimal cooperation in order to reduce the risk of making mistakes, to maximize the opportunities for increasing the success of students and minimize the risk of impacting the progress of students negatively via a flawed implementation. Secondly, change is becoming a more frequent endeavor than in the past. Today's work and school environments consist of rapidly changing technologies. As we expect to see change more often, it is important to understand how to implement it successfully and create an organizational culture that is geared towards an expectation and adoption of change.

2. Literature Review

Barbara Levin and Lynne Schrum published a similar study (2013), based in the United States "Using Systems Thinking to Leverage Technology for School Improvement: Lessons Learned from Award-Winning Secondary Schools/Districts". This study concluded that eight particular factors are required for successful school district technology implementation:

1. Vision
2. Distributed Leadership
3. School Culture
4. Technology Planning, Infrastructure and Support
5. Professional Development
6. Curriculum and Instructional Practices
7. Funding
8. Partnerships [33].

I found the conclusion of this study intriguing since it stated that all eight factors needed to be present and leveraged to full potential in order to ensure a successful implementation. Since schools and districts are unique in nature, I was puzzled as to how this measure of success

was defined and established and how the authors came to the conclusion that all eight factors must be evident.

Levin and Schrum's study sparked my interest to find out more about the eight factors they listed as required in school district technology implementations. I would like to understand their importance further by learning what each of them mean to superintendents in a particular school board in Canada, specifically in the diverse province of Ontario. I would like to see if participants attribute more importance to one factor versus another and whether the degree of presence of each factor will be noted by participants.

I turned to more research studies on the subject of technology implementations in K-12 context. It turns out various studies, which observed the changes in education due to the infusion of technology, named similar factors of success required to conduct these types of changes in schools. Liu and Szabo [34], for example, examined teachers' attitudes toward technology integration in schools over four years. They observed five "interventions at the school or district level for improving teachers' technology integration":

1. Instructional resources
2. Technical infrastructure
3. Professional development
4. Leadership type in schools and Guidance [34].

Another study outlining issues with preparing teachers for ICT-TPCK (Information and communication technologies - technological pedagogical content knowledge) states: "The preparation of teachers in the educational uses of technology appears to be a key component in almost every improvement plan for education reform efforts", thus suggesting professional development for teachers is a key factor [2]. Yet another study by Kopcha [30] presents a systems-based mentoring model of technology integration, which includes the following factors:

1. Needs assessment
2. Vision and goals
3. Planning for technology infrastructure
4. Planning for teacher preparation
5. Curriculum focus
6. Establishing communities of practice [30].

Overall, research on the subject of technology integration in schools indicates that there are key components that need to be present to successfully implement technology in classrooms. These components always include professional development and often indicate leadership, vision, technology infrastructure, curriculum and instructional practice and school culture.

3. Conceptual and Theoretical Frameworks

This study leverages the concepts of Activity and Systems Theories. Activity theory is particularly well paired with qualitative research. Activity theory involves a framework that defines how important social interaction, environment and tools shape who we are and our reactions. "Activity Theory helps us examine how different outcomes are influenced by the interactions between features of the learning situation" [45]. This is specifically important to the subject of change execution in an organization where all the players involved have their unique perceptions, perspectives and participation levels

in the change. Roth [43], citing Holzkamp, summarizes Activity Theory and its origins as follows: “... transformations of individuals and their community, which result from the fact that human beings do not merely react to their life conditions but that they have the power to act and therefore the power to change the very conditions that mediate their activities (Holzkamp, 1983)” [43].

Activity Theory allows the researcher to develop a more inclusive and complete comprehension of the problem being studied. It does this by challenging the researcher to keep looking beyond the first factor or theme that emerges from a story being told. It challenges a researcher to look at the impacts of the described action, its participants, and role divisions between participants, the action, the tools, and the 360-degree lens of impact. For example: “Failure is ‘the belief or judgment that learning is impaired by malfunction of learning tool or information source’” [5]. Failure has a multiplicity of meanings in this context. For example, it can mean technology failure, student failure, expectation failure, course failure or community failure. The consequences of failure vary greatly. Activity Theory helps us to consider the range of factors that influence and are influenced by failure” [45]. In their application of Activity Theory to education-based research, Scanlon and Issroff concluded “Activity Theory and an extended set of evaluation factors could be used to produce more meaningful interpretations of data for summative purposes” [45].

Because my efforts toward contributing to practice are centered on being able to validate a list of success factors and therefore a guide for others to use in their implementations, I also draw on Systems Theory. Systems theory encourages looking at social interactions with a holistic view [12]. Rather than reducing the problem or breaking it down, systems theory enables drawing themes or ‘the big picture’ from the study.

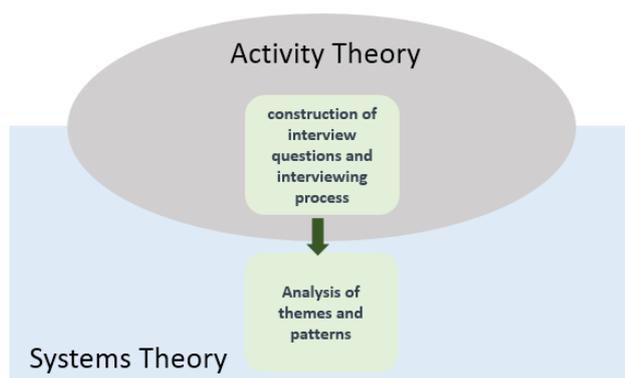


Figure 1. Theoretical framework

Overall, my theoretical framework as depicted in Figure 1 is an interaction between Activity Theory and Systems Theory. Activity theory is applied during the construction of the interview questions and the interviewing process. An Activity theory lens enables to identify what actions and interactions take place during an implementation of particular technology related initiatives. Systems Theory, on the other hand, is the lens utilized to draw patterns that enables conclusions and leads to concrete factors of success that can be used in practice going forward.

3.1. Contribution

I hope this research paper can be used as a reference for school boards, superintendents, principals and schools in the adoption of change. This research will be based on Levin and Schrum’s success factors to guide school board leadership in inclusion of key components of technology implementations. Successful program implementations lead to less anxiety in the workplace and enable the teaching staff to continue being facilitators of students’ success, without the turbulence that unsuccessful implementations can create.

I strongly believe in technology being a positive influence for student learning. Herrington and Kervin [43] validate this belief in their study “Authentic learning supported by technology: Ten suggestions and cases of integration in classrooms.” In this study they concluded that technology enhances the education experience for students and that students benefit from technology as part of instruction because the experience the learning provided, in comparison to teacher delivered fact-based instruction [43].

3.2. Research Methods

This is a qualitative research study. Because of the unique nature of schools and school boards, qualitative study allows a detailed level of questioning and understanding of each school environment described in the interviews. As a constructivist¹, I believe that the success of technical implementations in schools is affected by how it is being integrated in the system. What factors does leadership consider when conveying the change to the system? What do superintendents do to elicit the required actions from principals? I am interested in seeing the whole story and determine whether multiple accounts will validate the factors uncovered by Levin and Schrum.

The interviews refer to specific projects as part of the overall program implementation for the 21st century learning and teaching vision. This is designed to help the interviewees to focus on specific examples and recall their actions associated with particular implementations. A qualitative approach, conducted via face-to-face individual semi-structured interviews allows a descriptive conversation, which reveals the participants’ change management practices and how they applied them in successful technology implementations.

3.3. Research Focus

This research focuses on five areas:

- 1) What programs and policies were created to respond to the evolution of education toward the 21st century learning and teaching practices?
- 2) How are policies and programs implemented within the school board (what is the process, what is the information flow)?
- 3) What are the central school board leadership staff’s thoughts about the Levin and Schrum success factors required in technology implementations

¹ Constructivism refers to a psychology-based theory of education, which suggests that humans learn from their environment and experiences.
http://sydney.edu.au/education_social_work/learning_teaching/ict/theory/constructivism.shtml

4) What do superintendents have to say about the eight factors described by Levin and Schrum and how these played a role in their schools' technology implementations?

5) Finally, drawing from the areas above, what methods work in implementing technology changes in Canadian schools, and to what extent do these complement and/or differ from Levin and Schrum's success factors in the US context.

3.4. Data Collection: Semi Structured Interviews

Semi structured face-to-face interviews were conducted. Although expected to last approximately 60 minutes, most ended up being well over and even into 2-3 hours. The questions were built upon the eight success factors identified by Levin and Schrum in their analysis of successful school technology implementations [33]. Participants were stakeholders who played a key role in successful technology implementations as these were deployed through this school board. Because I was interested in hearing their individual stories of success, it was important to conduct individual interviews (rather than group based). Each interviewee was assigned a code to maintain confidentiality of participants. Notes were taken at the interviews. Responses to questions were consolidated into themes, and the themes are presented as a summary of each identified factor of success in the chapters that follow.

4. Interviewees

A total of nine interviews were conducted. Two participants were able to provide input based on two different roles they occupied during the timing relevant to this research. Their perspective brings the total participant input to the following group:

- Communication and Community Relations Department management representation
- Curriculum and Instruction Department Head
- Instructional Teaching Coordinator
- two IT Managers
- Principal
- School Support Officer – Policy
- four Superintendents of Education

The following chapters present interview data organized as follows:

Chapter 5: A School Board's Journey to change

All of the interviews naturally started with each participant's reflection on the journey being referred to in the interviews. As this example of system change covers a time period of at least 3-6 years, all participants provided their recollection of the sequential events and the wider context that led to the changes in this board's approach to education. This chapter consolidates the stories of this journey, as told by the participants.

Chapter 6: Data Analysis

This chapter is a discussion of each success factor that emerged in the Schrum and Levin study and the participants' experience with each of the success factors [33]. This section offers examples of how the various factors were creatively used to bring successful change into the school board.

Chapter 7: Success Factors according to interviewees

Each of the interviewees, was initially asked for their "absolute must have" success factors for technology implementations in schools. This chapter lists the factors that emerged.

Chapter 8: Emerging themes summary

Were the participants aligned in their view of what has been happening in their board? Were the participants placing similar values on success factors required to execute technology change in schools or did their opinion of these vary based on their roles? This chapter summarizes the researcher's observations.

Chapter 9: Concluding Statement

Overlaps with organizational change management research and implications for school boards. In this last chapter, some of the research that was raised by participants in the interviews is looked at, along with themes and philosophies they referenced. Implications for practice and the execution of technology change in education are discussed in final remarks.

5. A school Board's Journey to Change

"For centuries, during the whole time of organized mass education, the emphasis in the classroom has been on content acquisition; 'how much content can you memorize and give back to me'. All of the literature about what will be required of students when they enter the work force, is about how to work across disciplines, integrate content from a bunch of areas and put it together in new ways, to solve new problems. Repetitive jobs and standardization are not out there anymore; this is extinct already. Not all teachers yet understand that eventually we will have students evaluated a different way. How do we pin point what a classroom of tomorrow looks like? We don't have that answer but I think it will take the collective to co- create that vision." [25].

The world in which students are living has completely changed from the generations that comprise these students' parents and teachers. The interviewees, specifically the educators, in this study, placed an important emphasis on the global changes being experienced in education over the past few years. Their synopses were very impactful and indicative of not only a strong understanding of the need to propel the change in their own school board but also indicative of a passion for making this change happen for the benefit of students.

Moreover, I heard and felt the urgency and desperation to provide an education for students which is relevant to the world they live in. The following is the story of the board's journey to transformation, as told by the leadership roles who participated in this project.

5.1. Technology in Schools

The scope of technology in education has dramatically evolved during the last decade. Computer studies first focused on learning early programming languages, then there was the introduction of software suites and finally the influence of the internet was evident. Schools, in the 1990's were equipped with computer labs and network drops were provided in each classroom in order to connect it to the internet.

However, near 2009 it became evident that the world around us is changing at a faster pace than our schools. We were not evolving fast enough to catch up with it and educate for living in it [25].

5.2. Job Market Changes

We started seeing things like bank tellers getting replaced by cash bank machines, online and telephone banking. We started seeing manual car washes being replaced by automated car washes. Canada Post mail was being replaced by email and mailboxes were starting to disappear from home delivery. We started seeing a lot of jobs being automated. These were jobs people relied on. Something big was about to happen. The labor market was changing and soon it was evident that the world is changing but education was lagging. Next major wave was music sharing and Napster. Napster wiped out the record industry as we know it and forced it to morph entirely. This fundamentally moved us away from LPs, audio tapes, boom boxes, walkmans, discmans and to ipods. Everything around us was changing at a faster pace than ever before [25].

5.3. Technology as a Research Tool

Once the internet became a source of information and websites such as Wikipedia put Encyclopedia Britannica aside, schools stopped their reference material purchases. At this point, the Internet grew into puberty but students were still sitting in rows, teachers were still the center of knowledge and libraries were resistant to bring in computers [25]. Technology became a research tool. Since then, technology made its way into various areas of education such as:

- Overcoming challenges in rural areas and countries where teachers and education resources are less available
- Making education accessible on a broad scale
- Allowing to learn from each other (country to country, market to market)
- Allowing more data and breadth into students' learning opportunities
- Increasing teachers' productivity [49].

5.4. Inside the School Board

“While the world around was fundamentally changing, propelled by advancements in technology, education organizations were not changing. It was becoming clear to see that we were stifling students who were learning in spite of us because they could see things that we could not yet see, as an institution. This was not particular to a single board, but a symptom in education in general, globally. As educators, we had to take a closer look to see what was happening with our students. We assumed they could move in a compartmentalized way from one box to the next and next. However, we started recognizing that this model of learning is leading to disengagement and boredom. At the same time, much more data started becoming available about learning styles. For example, data emerged about boys learning differently than girls, data regarding graduate rates not rising, data regarding school performance. Our systems were designed to categorize, punish and weed students out. We started

moving away from norms based assessment to evidence based assessment (termed ‘outcome based learning’ in its earlier days). When we started recognizing these symptoms of student disengagement, we started having discussions around remedies. There was a big demand on technology in the system suddenly. We demanded technology is present and available. We demanded upgrades and expansion of services. We realized that we did not have the technology infrastructure to provide for the influx of technology in teaching. Teachers and students wanted to use more technology based tools. We needed Wi Fi desperately. However, there were so many constraints in the way, such as lacking technology infrastructure, restrictive policies and inadequate hardware funding.” [25].

5.5. School Board Response

The response from the school board to the demands of change and to combatting the student engagement issue were the creation of programs to start the required system change. Interviewees were asked to describe projects that were born as part of the larger vision. Projects were classified into the three groups below by the researcher:

Technology initiatives:

Technology infrastructure upgrades

Wi-Fi implementation across all schools

Bring Your Own Device (BYOD)

Devices – various devices became available for schools to purchase.

Engaging the system in change:

Digital citizenship policy

Character attributes creation for the school board

Social media guidelines

Creation of the social media network

Mindshift change in teaching:

Mindshift around teaching and The Substitution Augmentation Modification and Redefining (SAMR) Model use.

The board made very bold and drastic moves in kicking off the initiatives named above. The Director of Education created a vision of learning and teaching in the 21st Century and communicated with the system that the board has approved additional one time funding to move ahead into the 21st Century learning and teaching by investing in its technology infrastructure. This vision marked a clear change of direction in teaching practices by leveraging technology as a tool. But although additional funding was assigned and the vision was clearly communicated and had the sponsorship of all senior leadership, obstacles still surfaced quickly [23].

Some of the obstacles defined in the interviews included:

- affordability of the technology that was in demand by students and teachers ability to maintain a highly technology infused environment [20,22,23,25,26]
- device comfort by students and teachers, especially with homework being brought home (different device at home vs. school) [21,26]
- having working devices and keeping them working was challenging. Teacher unions were reporting report card programs not stable enough. There would be examples of 30 devices available in the classroom but only 19 of them actually working [20,21,25,26].

However, the obstacles generated by technology were only the tip of the iceberg. The most challenging obstacles experienced were creating the mind shift with regards to the Substitution Augmentation Modification and Redefining (SAMR) Model use. The SAMR Model refers to the stages of how technology impacts learning and teaching. The natural progression to shifting learning and teaching practice by the use of technology is via Substitution, then Augmentation, then Modification and finally Redefining [20,21,23,24,26,27].

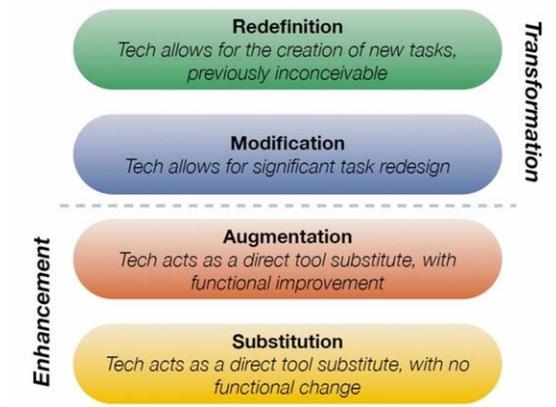


Figure 2. SAMR Model [44]

The challenges existed specifically with older teachers as the change required moving teachers to more collaborative methods which facilitate discovery, rather than traditional ways of acquiring knowledge. The school board also observed that younger teachers tend to use technology differently as they naturally adopt it as a problem solving tool and this natural integration of technology in the classroom will work itself through the system, but needs the required time [19].

In addition to having working technology and having the staff who are willing to change and adopt its use in the classroom, the challenges were further amplified by parent communities voicing their concerns with regards to wireless technology routers being installed in schools and a perceived transfer of cost responsibility associated with the Bring Your Own Device (BYOD). The resistance to change was surfacing from inside the organization, as well as outside. The board found ways to overcome the resistance and engage their senior leadership team in organizational change management [19,21,23].

5.6. Strategy

Faced with challenges and resistance from inside and outside, the school board began its mission to transform education as we know it by equipping its schools with the technical infrastructure required to carry out its learning and teaching vision. Next, superintendents and senior leaders were dispatched to various Canadian and American school boards to research what others were doing to advance education methods. The senior team also started reading and listening to various individuals who were emerging as spokespeople for this new educational movement [26]. Leaders such as Michael Fullan, Will Richardson or George Couros became a conduit to various ideas which were then turned into the strategy for change of education at this particular board [19,20,23,24,26,27]. An internal report on the current state of culture, cohesion

and a measure of how staff and leaders in the school board perceived these required changes was conducted by third party experts in the field of education change. The report's findings validated some reasons for an adjustment in strategy to create change [23,24,25,26].

The various tactics described by the interviewees, which comprised the change strategy were 2:

- **Adopting a co-learning stance.** Collaborative enquiry happens when teams of educators, such as principals, teachers, superintendents, school board leaders come together to discuss student learning [23,24,26]
- **Adoption of SAMR model.** Helped to validate that substitution is a natural first step in progress [19-24,26,27]
- **Increasing Support Staff.** Technology (IT) resource teachers were added to provide the system with adequate support [19,21,22,23,25,26]
- **Establish a culture of YES.** Superintendents and Principals began to encourage risk taking and trying of new techniques in classrooms [19,20,21,23,24,25,26,27]
- **Superintendent role shifts to Educational and Innovation Leaders.** Enabling the Superintendents of Education to be educational leaders. Superintendents were traditionally considered to be managers rather than instructional leaders. Superintendents immersed themselves individually and as a group in knowledge seeking and bringing out ideas to experiment with [20,23,25,26]
- **Not implementing from the top but bottom up.** This board ensured that the focus was on grass roots messaging and movements, rather than being the leader of all changes [19,20,21,23,24,25,26,27]
- **Digital Citizenship.** Digital Citizenship refers to the release of character attributes that define the school board and the Digital Citizenship Policy. This initiative was released by the Board early on in their journey towards the adoption of technology. The policy educates staff and students with regards to being a part of a digital community and provides social media guidelines and lesson plan support for digital citizenship [19,20,23,24,25,26,27]
- **Technology Initiatives.** Technology initiatives such as wireless infrastructure were introduced, along with the loosening of rules around access to the internet and technology resources. Additionally, the introduction of various types of devices in the school board [19-27]
- **Bring Your Own Device (BYOD).** The board started encouraging teachers to open their classrooms to student devices, while purchasing various devices at school level to augment technology for students who did not have or choose not to bring their own devices [19-27]
- **Mind shift.** There was a lot of work, not necessarily in framed and defined programs or projects but rather as an overall strategy to change the culture and mind shift inside the school board to facilitate change. Adoption of the SAMR Model was one of the key undertakings to help with the organizational mind shift [19-27]

² The initiatives listed are not named exactly how the board internally labelled them.

- **Social Network.** The board engaged in an online, social network based peer network which became a platform for motivation and exchange of ideas between peers [19,21,24,26].

What was interesting about this huge transformation that the board undertook, was that its execution was approached differently than in the past. Almost all interviewees commented on the fact that the board had previously executed very much top down and this time around, all senior leaders were committed to avoid this type of change execution. For the most part, interviewees referenced a grass roots movement which was capitalized on by the board in order to allow those who were taking risks and changing education in their classrooms to become examples to all [19-27]. The board also created a series of Steering Committees. Participation on the committees was voluntary and open to all. Moreover, committees became open throughout the whole process so anyone could join at any time. From a couple of major committees, sub committees were formed which displayed the board's practice of distributed leadership. Sub committees were created to work on particular projects named above and the overarching steering committee made large strategic decisions [19-27]. The membership of these committees was very mixed, including resource teachers, key teachers in the system who were already championing some of the ideas that were just being planted, Principals, Vice Principals and various managerial staff from the central offices.

The major steering committee talked about how to best inform and engage staff, parents and teachers. Sub committees made recommendations to the steering committee prior to material going out to the system [19-27].

Overall, the steering committee decided to choose a grassroots implementation type. They wanted to identify and enable a champion at each school who was already trying and was willing to experiment with some of the change required as part of this large transformation goal. The risk with this approach, however, was that champions were self-identified. This was risky because the particular staff member may not be the most successful because of his /her relationships with others at the school. Some teachers could be practicing an exemplary shift in their teaching techniques but their interaction and dynamic with the other staff may not place them as ideal persons of influence. There was need for a strategic cooperation between the superintendents and the school principals to identify who the champions most likely to impact the school culture would be. In addition to enabling the school based champions, the technical (IT) resource teacher model was relied upon to further the knowledge and motivation in the system towards this change [19,24,25,26]. Another school board in the same region also chose grassroots implementation, but their strategy was to identify the most respected person among their staff (rather than the greatest technology enthusiast). This person was then sent on training and brought the knowledge back to the school [19].

Almost all interviewees were in unison regarding creating a culture of Yes [19-27]. The strategy agreed upon was to try different technologies and methods and not to be restrictive or dictate what teachers should be trying in their classrooms. Before long, the work began to pick up momentum. I heard that technology was already

spreading on its own because it has a natural appeal to students and creates a natural engagement in the classroom [23,24,25]. A lot of teachers were already turning to this way of teaching and the board focused on enabling them to experiment and take risks.

In the interviews, leaders described that the system is continually evolving [23,24,25,26]. Ideas are emerging from teachers and the natural flow of adoption as the word spreads is taking place. Leadership is focused on enabling, encouraging risks and keeping the social media network strong to keep everyone connected and motivated [19,24]. As certain experiments are tried (ex. flipped classroom), if leaders see a large adoption then they focus on the more traditional approach of formalizing that particular technique as a teaching practice, looking into policy implications, technical support and really managing the technique from an integration perspective [19]. The interviewees also provided an interesting perspective into their strategy. They realized that their change does not have an end goal but rather that they were creating a culture of change. They realized that in today's world, things will never be as stagnant and stable as in the past [20,23,25,26].

In all of the interviews, success factors emerged quickly and clearly in the conversation that led up to the interview questions. Some of these factors were already captured in this chapter describing the board's journey in educational change. These include the use of steering committees and therefore distributed leadership or influencing of the school culture. The next sections describe interviewees' narrative on the success factors that emerged in the U.S based study by Levin and Schrum.

6. Data Analysis

6.1. On Vision

The concept of vision emerged in the interviews quite differently than I anticipated. I really anticipated vision to be a very important and obvious element of success in this particular case study. However, what I found was that some of the interviewees paused during the question of vision's importance in implementations of change [20,21,22]. A couple of interviewees went as far as saying they have not even thought about it, but it is likely important [20,21]. After more probing, it was clear why I received such a mixed reaction to this question in the interviews.

The board leadership was very aligned during the interviews. The same themes were emerging and the same story was told, including some of the jargon used and key research that was referenced. It was clear that the board was absolutely successful in setting the vision for where it was headed. But then why such a mixed response to this question in the interviews? Interviewees talked about vision being difficult to define, being too broad, hard to measure [19,24,26]. Moreover, I was informed that vision just raises more questions [19]. Vision is also difficult to stick to because of the evolving nature of change [20].

In this particular board, although they officially did have a technology and a 21st century learning and teaching vision in place, the senior leadership did not describe it as a vision with an end goal. The senior leadership described

it as a path or a direction. They all knew which direction they were headed but refused to define it, purposely. The vision itself was not very technical or defined in nature. It clearly set the tone of where education in this board is headed. In other words, the vision existed at a very high level. Students were to be the curators and creators of knowledge [23,24,25,26]. But how?

The board purposely avoided defining and measuring and 'boxing' it, in order to enable it to reach its full potential and creativity through grassroots, bottom up movement that was emerging from its teachers [25,26]. Interviewees discussed that normally leadership spends about 70 percent of the time discussing ideas and only about 30 percent of time doing them [22]. The leadership at this board agreed to commit to 10 percent of time for talking about the concepts and 90 percent of time to doing it [24,25,26]. In addition, the leadership group was encouraged to model, rather than just talk about the changes [24,25,26]. They knew that in order to ask their teachers to change, they needed to model that change first. They needed to feel the pain of learning and adoption of new concepts and breaking of their own habits.

In addition, the reservations around relying on a formally defined vision were around the common pitfalls of vision creation. Interviewees discussed the importance of a vision to incorporate all stakeholders and the importance of a vision to evolve through the eyes of the child and be central to the child's (student's) benefit [25,26]. Vision should not reflect the board or school based goals but be central and reflective of what is truly the core goal – the student. One superintendent described this as a "Backward Induction Model" [25]. Taking a look at the end goal; "what is it that we are trying to provide that student?" and working backwards to create an environment which provides those skills.

"If I know what the end game is, I know how to create it. If I try to impose it, it will be seen as top down and that will have a short shelf life. To create these conditions, I have to do a lot of work in the background. But I do that work consistent with the model, first look at the students you are serving. What the students need is not simple. They need to be resilient, open minded, critical thinkers. They need to be flexible. They need to be collaborative. They need to think outside of the box as the norm not the exception. These are my personal beliefs. But I need someone with credibility who has similar beliefs so I can latch on to them and find an expert who will have the well respective perspective. This is where I lean on Michael Fullan's six Cs, which led to my vision" [25].

The reference to Michael Fullan's six C's refers to the following six areas which represent students' required future skills as described by Michael Fullan, a Professor Emeritus of the Ontario Institute for Studies in Education at the University of Toronto, a leader in educational research and an advisor to major education contributors world-wide. Michael Fullan is also one of the key leaders in educational transformation who worked closely with the interviewees of this study on sharing the philosophies and practices that constitute successful educational change. Fullan's six C's are as follows:

1. Character education – honesty, self-regulation, responsibility, hard work, perseverance, empathy
2. Citizenship – global knowledge, sensitivity to and respect for other cultures

3. Communication – oral, written and use of digital tools, listening skills
4. Critical thinking and problem solving – to design and manage projects and problems
5. Collaboration – work in teams, learn from others and contribute
6. Creativity and Imagination – economic and social entrepreneurialism [10].

The superintendent [25] in the quote that begins this section explained that a change conducive environment sets up people yearning for something. All the interviewees defined vision in the context of the environment in which it is embedded, rather than it being a statement that everyone just memorizes.

Interviewees [23,24,25,26] educated me that central to the creation of a vision is flattening of the hierarchy in order to capture all the perspectives and voices. Vision, I heard, needs to be built on top of solid relationships and a good communication structure. The working relationship is an absolute must-have to having a vision [23,24,25,26].

It was music to my ears. I heard clearly how Activity Theory was subscribed to by the interviewees. They described vision not for what it is but also what organizational conditions need to be met in order to have a successful vision. They spoke of how the environment and culture need to be set up in order for vision to gain traction.

Lastly, interviewees [24,25,26] spoke of vision as not a constant. Adaptive was the word used to describe it. "More so than any point in history, staying static will just not work. Rate of change has been much greater than it ever has been" [24]. In fact, the current vision was already under a revision through the distributed leadership style steering committees the board used for recruiting ideas and for forming plans [20].

And so, in the very first question, the interviewees impressed me immensely. I read many articles, various research and case studies on creating a vision. I worked in various organizations and took part in the creation of vision and mission statements, strategic plans and change management plans. However, after just one question in each interview, I felt such a maturity and I could see that the whole panel of interviewees were so immersed in the changes happening in education, so eager to make an impact, so educated in how to contribute to this movement and so committed to education. I was truly inspired and ready to learn more.

6.2. On Distributed Leadership

"Distributed leadership – there is no option but to practice it. How we do this cannot be separate from the philosophy that it is. The philosophy is about empowering people to innovate, giving them the power to innovate. Having the vision moved us towards that direction. It is the same thing with distributed leadership – Some themes are essential to moving ideas forward and flattening the hierarchy is one of those. This is the most important thing that has happened in education in my lifetime. It will have the most profound effects in education more than anything else we have talked about." [24].

The interviewees conveyed a strong belief and practice of distributed leadership in their school system. They realized that a lack of engagement and inclusion of various participants in opportunities to lead and champion

components of change will not lead to successful realization of organizational goals. Interviewees [19-26] explained that distributed leadership also gave them a tool for engaging participants to buy into the vision. This particular board established a distributed leadership culture through their use and reliance on steering committees for any large undertakings.

Within the committees, members are assigned roles based on strength and ability to make progress. What is interesting is that the use of steering committees and encouraging various people to hold positions of leadership on various opportunities permeates through the organization from the central head office to all schools. Schools are run in the same manner. The Director's Office and its coordinating Superintendents of Education run in the same manner. "It is how we get work done", I heard [20].

Superintendents are in the practice of creating a group of champions and a feedback loop [25]. The culture of the school board just a few years prior was completely different, with the "My House, My Rules" mentality when it came to direction setting [22]. I heard about various initiatives that went sour due to a high ratio of prescriptive dialogue around these [23]. In fact, there were even fairly recent examples of initiatives which were more prescribed and top down which were not as successful as the 21st Century learning and teaching initiative [23]. I heard from a couple of interviewees that it should really be noted how things were done on this program due to its success [24,26].

Was it as easy as it sounded? Delegating the responsibility is one challenging area but the various groups of people need to be collaborating as well. The challenge with the model, I heard, is that distributed leadership still relies on relationships. Allowing people into positions of power and leadership over various components, really requires the knowledge of that particular person and their dynamics with the team they are working with [24,25]. Choosing the right person to spearhead a part of your goal entails a very strategic appointment to that role, with the consideration of all personalities on that core team and their ability to make a wider scope impact in the system [23,24,25]. Just as with the discussion on vision, I heard about a level of complexity that is so core to the success of the concept of distributed leadership, but one that is not usually described in research.

6.3. On School Culture

"10% of your leaders are jackrabbits. They will go with anything. GO GO GO! 80% will go with the flow. They are on a boat and will float your way. 10% are anchors and will hold you back. Rather than focusing on the 10% anchors, focus on the jackrabbits, support them and now you've got 90% moving where you want them" [25].

Participants in this research told me that climate in the school is set by a principal. Culture is influenced by the climate that the principal sets. A Good principal models co-learning and collaborative inquiry [19-26]. The principal has to say yes to ideas and they have to facilitate. But they have to know how to say yes as it is often challenging to say yes. For example, how do you say yes to the idea even when it is unaffordable? [20]. How do you keep the teacher engaged when you cannot agree to the idea

because it exceeds your budget [20]? You have to come up with alternatives and negotiate with your staff in order to keep them engaged and motivated. You have to keep equity in mind as well [25,26]. Workplaces where people are cooperative, respectful and take responsibility for their learning, create a climate conducive to executing the vision [25].

Creating a school climate is not an easy task. Multiple resources in the central board office are available to help with climate, restorative circles, and to create opportunities through staff meetings [19]. Even setting the tone for the day is an important piece of climate change. Leader setting the tone for the climate in the school is huge for goals of the school [19].

Superintendents are also responsible for the culture within their schools. Superintendents, meet every week to share ideas, to critique each other, to get rid of bad ideas and to build a culture [19,20]. "School culture is a chicken and egg thing" [21]. School culture is different in each school. There are school cultures that are severely or highly impacted by a principal. We have had principals who have visibly changed cultures every time they moved to a school. You can have an administrator who does not trust staff or one that really is interested in what they have to say.

There are so many factors that affect the dynamics in the school [22]. There are definitely teacher leaders who may be able to impact the school culture at teacher level and beyond. Regardless of whether it is the principal who is driving the ideas in a school or principal working with the influential teachers or the teachers themselves, there is a definite improvement and engagement when there is respect. Respect of each other's expertise is required to form an engagement dynamic in the school [19].
Setting a mindset

Interviewees noted that education was built on an industrial model just like production of cars, we came up with a process and we repeat it again and again. We keep tweaking the process to make it more efficient but not necessarily more effective. We have to keep questioning our effectiveness. How do we do that? In a perfect world the questioning of the role constantly would come from the teachers and the principal's role is to promote this questioning and provide teachers with the means to keep their role evolving. For example, one of the interviewees [26] placed books in teachers' mailboxes and pretty soon teachers were talking about the ideas in those books. "As a principal", I heard, "you have to model the idea of thinking outside of the box. You have to be an active learner" [26].

Being manipulative, with a purpose:

Are there people who cannot be brought on board with the change plans? When it comes to teachers, you have to inspire, you cannot tell them what to do. How do you inspire? One interviewee [25] offered some insightful comments:

"As a superintendent, everything I do is manipulative and calculated, but the approach in doing it is to get people to engage and take ownership. I cannot run all schools in my family of schools, but if I can steer you to sunny skies and you can see that, chances are you will go there. If it steers you into a pit, chances are you will get away from the pit so you will have to do something about it. What works for me is using "pressure points". Pressure

points with my principals are when they have to explain their data. I can use our own report card data, EQAO, parent concerns, suspension rates, lack of extra-curricular activities, community surveys, etc to demonstrate a real need for action. I can help to work with them towards action that encompasses change. When you do not have buy in that people can easily understand, you will certainly have buy in when they have to rationalize their results. I create the conditions where my people tell me why things are wrong, they help me to understand and I help them to come up with the solution. Moving people entails multiple strategies. I used to spend 50% of my time on 10% of the people that would not move. Now, I always start with the people who are eager to try new things and move forward. What is more is that I work with the eager ones. I model and I start a movement with the people who are respected and trustworthy and motivated. If I focus my energy on the change and the positive people, I can create a movement. [25].

6.4. On Professional Development

This particular board decided from the start that there is a difference between training and professional development. They focused on the professional development and let the training happen by itself. In the United States the focus has been on the training piece. So not training teachers but allowing their creativity to come out by itself was a major decision [20,23,24,25,26].

The board had previous examples of top down implementations, with formal mandatory training. These initiatives displayed the importance of buying in from staff prior to implementing and training. The board, after these experiences, understood that the energy must be spent on getting people naturally hooked and interested to changing their ways and the training plans will follow [23].

What the board decided to do instead is to work directly with the champions of change. The teachers who were already leaders in technology adoption were further supported [19,23,24,25,26]. Superintendents were watching what these teachers were doing and allowing them ways to experiment by providing access to technology, conferences, speakers and resources.

Professional Development became very organic in the organization. A sub-committee of the Steering Committee for the entire program was tasked with the learning and teaching agenda. The sub-committee felt it was most appropriate to make sessions available and have teachers sign up to what sparked their interest [19,54].

Some of the characteristics of professional development in this board were described as:

- Teachers teaching their colleagues (targeted at the teachers who are technology shy and therefore would not sign up for a technology conference [19])
- One on one or self -directed options for the technology shy [19,22,25,26]
- Self-directed learning shared in a collaborative fashion [19,24]
- Multi-tiered approach and multiple entry points for the different stages of learning [19]
- PD is not something that is done to you, it is something to engage in [24]
- Most of the learning is through one's online network. Teachers are showed how to connect with people

who are learning the same things and every day spend some time educating in the network [19,24,25,26]

- “Un-conference” – the board established conferences where participants sign up for topics of interest and join sessions to further explore that topic [19,23,24,25,26]
- “Choose your own adventure” Professional Development. Schools put together a carousel of offerings. Staff were surveyed for topics of interest. Administration with school committee chooses 8-10 top choices. Staff members who developed competency in the particular areas do the leading and learning. It is important to note that the teachers chosen to lead the PD may not be experts in the competency but are engaged and on the journey to mastering the competency [24,26].

The board's goal was to establish a Professional Development framework that would cater to various levels of need and learning styles [19,25,26]. Moreover, the board identified Professional Development as a key factor in moving them forward on the spectrum of change. However, they noted that Professional Development in itself is evolving from its traditional definition. The future of Professional Development required a much more organic and collaborative effort [24,26]. It is self-initiated, self-directed and based on relationships with other teachers [19,24,25,26]. The vision is that teachers will be given the possibilities to work together by visiting each other's classrooms. Currently, this is taking place via “Instructional rounds” conducted by superintendents. Superintendents then share the work they witness, they find out who the leaders in technology are and work closely with them. The future is in building the culture where teachers are learning from each other [25]. Collaborative inquiry and co-learning stance are descriptions I heard from all of this study's participants. The emphasis on the future of Professional Development surely relies on collaboration and therefore relationships. Once again, the importance of not only school but organizational culture is emphasized. Creating comfort, creating a good comfortable, safe space is where the board is placing its energy when it comes to Professional Development. [24].

The other important message with regards to Professional Development is that it is not to be centered on the technology. “Always start with the curriculum”, “Pedagogy at the center” is what I heard from Interviewee 4 [22]. Participants described when the board provided its staff cell phones. Upon receipt of the new phone, staff signed a form and received no training. Technology can be learned once it is in your hands. The bigger emphasis on learning is for teachers to understand how and why education is evolving and how the pedagogy is impacted, rather than how to use a particular piece of technology. [25]. Professional development must be designed in a way that models what the expectation is. Leadership for the board realized they cannot put teachers in rows and do what they trying to get away from as a learning format. Social Network:

A large part of the board's strategy to establish a culture of change and a part of its Professional Development strategy has been their social media network. This board was successful in establishing, very early on in this

journey, a social media network which has been very active and growing since it was started [19,24,26]. Teachers exchange ideas, comment on each other's ideas and moments from the classrooms. Various speakers and leaders in the educational change movement have been part of the board's strategy and have become a part of the social media network as well [19,24,26]. Web sites such as Twitter are used for professional development and general exchange of ideas between teachers. These tools allow for an ongoing engagement and progress in learning. They keep people engaged over long periods of time. They build unison and comradery and widen social networks within the outside the organization [19].

6.5. On Technology Planning and Technology Infrastructure

A dependency on a reliable technology infrastructure lies at the foundation of this whole educational movement. This particular board recognized early on that in order to commence their journey, they will be relying on a level of technology that needs to be the same in all the schools. As such, the school board dug into their reserves and heavily invested in their technology platform, even prior to the beginning of their work on changing the system.

Some basic infrastructure, such as having wireless capabilities in all schools in order to experiment with various devices was given priority [19,22,23,25]. Next, the board relaxed its hardware recommendations and allowed schools to choose the technology they found best suited for each school. The board ensured to relax rules around internet access as well. Essentially, schools were provided a technology platform which enabled them to experiment with various types of technology and techniques [22,25]. To allow these changes, numerous staff needed to rethink the way business had been done for years. Technology staff had to become extremely flexible and non-prescriptive. Technology staff no longer had the luxury of setting rules most effective for the management of technology but rather, the goal was to provide utmost flexibility for teachers and the ability for teachers to try whatever they wanted without any restrictions. Technology staff had to begin to support multiple platforms and devices [22].

During the interviews, I heard over and over that technology is the ground work. Students should have a variety of devices for variety of purposes [20,26]. Students should not be all using the same device [20,24,26]. Students are not robots. Part of the problem solving skills students need to develop is the ability to pick up any type of device and be able to use it. The goal is to create problems such as to present students with different tools and different problems and ask them to solve these problems.

In the classroom, technology is an important accelerator, not a catalyst. Having Wi Fi at a school is great, having technology is great, but it is not the catalyst. The success is most of all dependent on the teacher to create real world problems which allow the students to resolve and gain new skills while doing so. The power of technology was well defined by one of the interviewees who stated that even though classes are still restricted by the number of minutes dedicated to each period, technology now allows the inclusion of experts from around the world in classroom discussions [25].

Due to the demands of changes in the system, to accommodate an upgraded technology infrastructure and a wider offering of hardware and platform types to classrooms, technology staff have been evolving to keep up with the new demands. The ideal technology support was defined by participants as:

- Completely integrated with education [19]
- Delivered by technology staff who are open to collaborate with the educator teams. Cross collaboration is key [19,21]
- Network stability is crucial [19-27]
- Communication as to why technology is not working is also crucial. This goes back to (organizational) culture and respectful relationships; respect people's time in the classroom if things are not working [20].

6.6. On Curriculum and Instructional Practices

"Pedagogy is at the center of what we do. Ultimately curriculum is at the heart of it. It's going to dictate where we are going. Far more important. It's the catalyst ...it's the buy in for the teachers...it's the epicenter. It's our core business. Change management is the difficult part – technology is the easy part." [22].

This board invested significant funds toward their technology resource teacher model. Numerous technology resource teachers were hired to support classroom teachers throughout the system with their journeys towards technology adoption and the evolution of education. These resource teachers were relied upon to build the connections between technology and curriculum. In other words, the true task was to move teachers from substitution towards R in the SAMR model [21].

Part of the technology resource teachers' directive was to boost staff morale and help them understand how the technology is making an impact. In other words, it is to help move teachers toward understanding and buying into the reason for the changes to the way they teach. Helping staff understand they have a key role in the success of students is a huge task [21].

In addition to the resource teacher model, the board heavily relied on modeling what they wanted to accomplish in the classroom. Various levels of leadership were modelling, even by changing simple things like carrying a book or iPad to meetings [25,26]. Notebooks and pens were replaced by technology. Meeting and presentation formats were changed. Leadership got involved in social media platforms [19,24,25,26]. Leadership gave schools and teachers permission to experiment on their own as well.

Various other techniques were experimented with in order to capture attention, drive motivation and engage teachers. A new concept of conferences, named "un-conferences" were held. Keynote speakers were invited. Teachers were given options to show up and learn about technology in the classroom. Sessions were delivered according to themes teachers wanted to learn about [24,25,26]. The board also held Technology conference in the summer, 325 teachers showed up in the first year and an excess of 600 people showed up in the second year. Families of schools held "Appy Hour". A time during which teachers would have a coffee and share their favorite apps. Schools also organized Poster sessions

during which booths were set up to talk about how technology is used in a particular classroom or a school. “You have to do impactful things (un-conference, learning lunch etc.) sometimes a lunch for 3 will make a bigger impact in a school than a PD for the whole staff” [24].

6.7. On Funding

Funding has become a major player when it comes to success factors for technology implementations. Technology implementations are necessarily tied to cost as new technology always involves a cost. The evolution of education is dependent on technology infrastructure and resources for teachers and students.

Although many school boards are hopeful that BYOD (Bring Your Own Device) programs will alleviate some of the cost issues for school boards, the strategy is quite long as most school boards still struggle to ensure an adequate technology infrastructure is in place in schools.

When it comes to funding, there are many areas outside of technology that require funding. Professional Development is a very important factor during times of change and can also be a very costly one. In addition, there is the development of communication materials, translation of letters for parent communications and other items that tie back to an increased demand for funding in order to support major change execution [19].

Another area creating a demand for funding is the evolution of classroom set up, maker spaces, learning spaces, learning commons etc. As areas of the school are evolving to accommodate the new learning style, the funding demands grow with them [20]. However, other interviewees [22,25,26] highlighted that as they visited with various school boards, they found that there are school boards with fewer resources that have often been very successful with their technology adoption. Funding is not the primary condition of success.

6.8. On Partnerships

There was a visible difference between the American versus Canadian reliance on partnerships in education. Interviewees in this research emphasized the need to form internal partnerships more so than the external partnerships defined in U.S based research.

Some interviewees even acknowledged the geographical difference on this subject. Partnerships are not as heavily relied upon in Canada [19,24]. In fact, the partners identified as critical during this time of change were the board’s trustees. Trustees need to help the board to access funds and amend policies as required to support the systemic goals they are working on changing [23].

Trustees need to be ‘brave’ as they are accountable to the public. In the case of wireless technology implementations, trustees received a lot of community revolt at firsts, as the idea of Wi-Fi in schools seemed threatening to parents [20].

The other partnership identified was with technology vendors. There was some discussion by the interviewees that indicated there are opportunities to form better partnerships with technology vendors which can be leveraged in schools towards better integration of the technology through trainings support or volume discounts. Interviewees definitely did not feel that paying full value

for a device by the board and by parents was the most opportunistic deal for education [20,21,23,25,26].

In general, interviewees were split on the idea of schools doing more with corporate partners. Some felt that since parents and students spend money with organizations such as fast food restaurants, then why not capitalize on fast food restaurants contributing back to the community by allowing contribution to the school? [20,26]. Others felt that to rely on a business for contributions may take the freedom of choice away from education down the road [19,21]. Also, there is a concern about working with organizations that exemplify the values being taught by the board [20]. For example, development of healthy lifestyles and how this ties in with sponsorship by a soda company. Perhaps association with a less than prime nutrition choice type of product is not a most ideal partnership for a school board. Interviewees discussed partnerships with other organizations which provide opportunities for our students. This included partnerships with Universities who provide space for our students for weekend classes and extra opportunities for engagement and learning [24,26].

7. Success Factors according to Interviewees

Each of the interviewees, was initially asked for their “absolute must have” success factors for technology implementations in schools. The following list is a summary of factors discussed by this particular groups of educational leaders. A further discussion of these factors follows. The factors were organized into categories by the researcher.

7.1. Culture

- Championed by well-respected colleague [19]
- Culture of Yes – instead of thinking of reasons why it will not work, think of why it will. Also, allowing staff to take risks and experiment with technology and ideas [20,24]
- Teachers who are innovators. Not afraid to take risks but also willing to listen [21]
- Co learning stance. Everyone is in this together; teacher, principal, superintendent, technical staff, resource teachers [23,24,26]
- Letting people make mistakes [23,26]
- Flattening of hierarchies – everyone in the organization innovates [19,23,24,26]
- You cannot dip your toe in it. You have to realize you are going to be submersed [25]
- Honor the knowledge and expertise your staff come in with [24]
- Create the conditions to facilitate the movement of your staff [25]
- Model the behavior, enable the technology, facilitate [25,26].

7.2. Leadership:

- Administrators who are champions of technology through modelling and supporting their teachers. Willing to listen to teachers [21]

- Do not allow it to be just one staff members who decides what to do [21]
- Vision of the administrator to be articulated [21]
- Collaborative effort – having a teacher lead the pact, having the teacher reach out for ideas and support resources [21].

7.3. Technology

- Technology that does not fail [19-26]
- Availability of online resources [19]
- Wireless infrastructure [19-26]
- Platform agnostic. The fact that we had to say we are going to be open to all platforms [23]
- Technology department open to change rules and management of technology to accommodate curriculum first [24].

7.4. Professional Development

- Multiple entry points – if you're a novice, you must logon and have novice tools. If you're more advanced, offer more advanced [19]
- Support and training for the teachers is most important [22].

7.5. Curriculum and Instructional Practice

- SAMR ladder: must move up the model. Cannot do substitution forever [20,23,26]
- Pedagogy: teachers willing to take risks. Being resilient and adaptable [20], [27]
- Rethinking of higher order thinking tools such as critical thinking skills. Engaging the world in problem solving. Having social conscience and developing morality and values [25].

7.6. Partnerships

- Partnerships between technology vendors, technology department and the resource teachers should be very collaborative to allow for the best options of technology in the classrooms [20,22,23,24,25,26].

8. Emerging Themes Summary

I expected to learn a lot but I found a level of substance and meaning in the interviews which was really impactful and impressive. The interviewees who took part in this project were extremely dedicated and passionate individuals. Their commitment to education was so apparent in just a few minutes into the interviews. They all conveyed the importance and urgency of why this major educational shift is so important to students, and to the Canadian future. One interviewee [24] even conveyed that he is afraid that his career and life will not span long enough to truly witness this educational shift. His passion to contribute, to move, to equip children with the skills they will need was so strongly felt across the table during the interview. These interviewees made me witness a motivation and career passion unlike another I have witnessed in the industries I have worked in. I feel that if I can convey just a portion of their message and share this insight with other organizations' education administrations, I

could contribute towards a movement in education which is much needed for our future generations.

The themes that emerged in these interviews were less about the factors required for technology change but more about creating a culture of change. This leadership placed its energy in creating the underlying understanding, sparking passion and conveying the urgency for educational change. The belief is that once teachers understand the need to change in order to equip students with skills they will need in their world, not our world, teachers will find creative ways to evolve their teaching practice. This is a little counter intuitive to how organizations have executed their goals in the past. Usually, long term goals are only clearly known by senior leadership in organizations. Senior leadership, in turn, breaks up the goals into numerous initiatives which become very scripted and prescribed in nature. This is the old style, top down approach. This board chose a different strategy. Long term goals and vision are shared and the importance of their understanding by teachers is very important to leadership. The actual ways to get to the goals are not prescribed, but rather, basic environment, infrastructure and culture essentials are prepared to create a change conducive environment. From there, it is up to the teachers to innovate and try what works best. Teachers are trusted, as professionals, to evolve their practices with best intentions for the students.

The philosophies and practices of successful technology implementations in the K-12 context which emerged in this particular school board's journey are:

- Grass Roots Movement
- Understanding the goal
- Open to experimentation
- Continuous, long term emphasis
- Modelling what you preach
- Genuine passion for education

These philosophies and practices are listed here due to their frequency of mention by the interviewees.

Grass Roots Movement

Emphasis on a grass roots movement. This board realized the importance of capitalizing on the teachers who were already the technology leaders in their schools. Providing these teachers with the attention, spotlight and equipping them with the tools they could creatively explore was key in gaining attention from others and creating a genuine interest in the system.

Understanding the goal

Rather than framing the journey of change as a journey with a definite start and finish and a prescribed, defined end goal, this board emphasized the importance of understanding why this change is important. The change in education toward the adoption of learning and teaching styles, with the tools of technology in the classroom, is likely a change that will keep evolving. Education may never have the luxury of being as stable and steady as it has been in the past few decades. The result of this stagnancy has been clearly proven by various studies illustrating a decrease in student engagement. "The research on brain activity by Rosalind Picard and her colleagues at MIT's Media Lab suggests that students' brain activity is nearly non-existent during lectures – even lower than when they are asleep" [11].

The key assumption made by this board is that their teaching staff are professionals who have the best

intentions in mind for their students. As such, the mere understanding of why equipping students with a new set of skills not previously taught in classrooms and shifting from fact base teaching to problem solving and project based teaching will naturally spark a need for teachers to evolve their teaching styles.

Open to experimenting

The board decided early on in the process that all policies, during the times of change, will be loosened in order to allow experimentation and organic growth and development. This started with the technology department opening up all rules around use of the internet, various operating system platforms and devices. Taking risks in the classrooms was encouraged for the sake of finding out what works best to engage students and stage learning opportunities to expand problem solving skills and encourage enquiry.

Continuous, long term

“Large-scale changes cannot be considered successfully implemented unless they are able to survive evolution of the system and remain useful in a changing world.” [6].

This change in education was presented to the entire system as a continuous, long term and evolving change. This led the board to focus on the goal of providing students with a classroom experience which encouraged enquiry and problem solving skills. The actual teaching methods and learning opportunities were not defined for teachers. Teachers were encouraged to organically evolve to meet the final goal, but at their own pace.

Modelling

Modelling became very important. In words of the interviewees, you cannot expect people to move if you are not willing to make changes yourself. The board’s leadership took the first step towards changing by adopting technology into the ways they do everyday things. They modelled by participating in the social media dialogue. They learned, they shared and they remained engaged throughout the whole process.

Genuine passion for education

The most powerful factor that became visible to me very early on in the interviews was the genuine passion for education on behalf of the interviewees. One of the interviewees went as far as admitting he is afraid that in his career he will not be able to take part and influence the full extent of the much needed education shift [24]. I felt this genuine passion from all the superintendents of education I interviewed. I could not help but to relate this passion with the success of this board’s three-year journey. When the people planting the seeds of change, enabling the change, fighting for the change and modelling the change are so extremely dedicated and passionate, I suddenly understood why the conversation in the interviews evolved so much from basic success factors to culture elements and philosophies that allow to create change in large systems such as a school board.

9. Concluding Statements

The practices and philosophies that emerged in the Levin and Schrum study in the United States, and the additional layer of change factors discovered in this research by examining the experiences of a large school board are confirmed in various literature.

The OECD (Organization for Economic Co-operation and Development) published work entitled “Schools for 21st-Century Learners” in 2015. Andreas Schleicher, the author of this work discusses themes such as:

- Distributed Leadership
- Professional Development
- Instructional Leadership (curriculum and instruction)
- Collaborative Planning Environments [46].

The Equinox Blueprint, a report published in April 2014 builds on a series of professional conferences on the subject of “Learning 2030”. It discusses changes required to propel education change for the students born today who will be graduating in 2030. This extensive report discusses the need to switch to project based learning in the classroom, the need for teachers to evolve as learning coaches, the need to start changing learning environments (classroom spaces, class sizes and age groupings of students), the need to revisit how students are evaluated and the need to give schools the ability to make their own decisions and have autonomy over their management in order to foster creativity. The report discusses the secrets to scaling such a large implementation:

Local input – the author refers to schools’ ability to mold their own reforms. This is consistent with this paper’s account of this school board’s emphasis on grass roots movement rather than a top down approach.

Global applicability through inclusive reforms – Schleicher emphasizes that the scope of this large change needs to be driven by a goal to “improve outcomes for all students” [46]. This theme was also echoed in the interviews with this board’s superintendents who stressed the importance of always originating the vision and all the outcomes of this change on the students these changes are meant for.

Sustainability through support networks – Schleicher discusses the need for large scale reform networks which will ensure sustainability of these changes. In the case of this board, we discussed above the successfully established and active social media network and the interviewees strong emphasis on collaboration and internal and external partnerships.

Pathway to change – Schleicher also discusses an entire pathway to change which is comprised of:

- creating an urgency, or, in other words, ensuring the understanding of what is a stake for students if they miss out on gaining the important skills they need to be equipped with for a world of tomorrow
- creating a coalition – assembling people of influence from various areas of the organization
- creating a vision – a vision around which to create a strategy
- communicating the vision – having the vision is not enough!
- remove obstacles - identifying change leaders who will make changes possible
- Create short-term wins – the coalition will map out the strategy which includes achievable targets that can be celebrated [46].

Although not termed in the same way, the concepts revealed by the board have since then shown up in most recent literature published on best practices for technology based education changes.

I hope that the findings in this study enable others, who are facing the challenge of creating change in large

organizations, to look at change through a different lens or perspective. Are you trying to create change but you are still stuck in your usual ways of doing things? Are you willing to change first? Are you truly leading the change by creating enough understanding to gain the required support? Are you rewarding your champions? Are you placing your energy and emphasis on the leaders or the nay-sayers?

I hope this paper helps you with taking a critical look at your approach and evolve towards a more mature, inclusive model for creating change.

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