

School District 22 - Vernon

Long-Term Technology Plan

2020/21

Designing the Classroom of the Future



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Prepared for:	School District 22 (Vernon)
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Revision History

<i>Revision Number</i>	<i>Revision Date</i>	<i>Summary of Changes</i>	<i>Author</i>
V 1.0	Dec – 2015	Draft 1	Tim Agnew
V 1.1	March – 2016	Draft 2	Tim Agnew
V 1.2	May - 2016	Revision – Educator Feedback	Tim Agnew
V 1.3	June - 2016	Admin Feedback	Tim Agnew
V 2.0	April - 2018	Update 2018	Tim Agnew
V 3.0	April – 2019	Update 2019	Tim Agnew
V 4.0	April 2020	Update 2020	Tim Agnew

Reference Documents

Please see the following documents for more information:

<i>Document Name</i>	<i>Author</i>	<i>Date</i>
SD22 Technology Plan – Development Framework	Tim Agnew	Oct - 2015
SD 22 School Ed-Plans	Various	April - 2019

1.0 - Executive Summary

The purpose of this plan is to continue to build on the District's current shared vision for transforming our classrooms and educational practices. The original District Tech plan and budget was approved by the Board in June 2016. It is essential that the plan be directly linked with the School District's current and future strategic plans. At the same time, transforming infrastructure, teaching practices and our classrooms is inherently a long-term endeavour and therefore this paper will map out a long-term plan that represents our best thinking at this time. The plan will suggest broad goals and actions that will move us in the direction of a shared vision. Of course, flexibility and agility are necessary traits in this age of rapid change. In keeping with this, we will treat this plan as a 'living document' and give ourselves permission to update and modify our ideas, as necessary.

This plan is broken into seven parts including sections on Learning, Assessment, Teaching Practice, Innovation (Research & Development), Infrastructure, Administrative Technology, and Leadership. As mentioned, it is critical that this technology plan reflect a District consensus on how to ensure that our technology services line up with curricular goals, and with activities in our schools and classrooms. The following are some overarching goals of this technology plan:

1. To ensure that technology services in School District 22 link to current and future curricular goals and activities.
2. To ensure that the technology infrastructure has the capacity to support curricular goals, now and in the future. Also, to ensure that technologies are implemented with industry best practices in mind.
3. To ensure that technology supports the business needs of the organization. To assess current administrative technologies to ensure that they are cost effective, of a high quality, and meet the needs of the district.
4. To look at ways to improve productivity through technology, by challenging and revising learning and business processes. To ensure that educators in the District are fully supported and have professional development opportunities that will facilitate our building the classroom of the future.
5. To look at ways to improve cost effectiveness and quality of services by working with other districts and developing shared services.

Completing This Plan

The primary purpose of this document is to develop, and continually refine, a long-term plan to ensure that technology in the District is directly connected to learning and assessment activities in classrooms. Working from a *Technology Plan Framework* (**See Appendix 'A'**), it addresses numerous Ed-Tech related questions that build on the existing vision and goals for technology.

It is also important that the Technology Plan be connected to other internal and external education related strategies / goals / artefacts including the following:

1. District Strategic Plan and curricular goals.
2. Aboriginal Enhancement Agreement.
3. BC Education Plan.
4. New formative-based assessments.
5. In concert with the ideals and specifics related to the BC K-12 Innovation Strategy.
6. BC's new curriculum, assessments, and reporting.
7. The Districts administrative and business technology needs.

Key Focus for 2020-21

The following will be the key areas of focus for the 2020-21 school year.

One Stop Training Site

The District has purchased and begun adopting many new technologies over the past several years including G-Suite, Office 365, Azure AD, ClearPass (for student BYOD), PaperCut (for printing), Insignia Library, MyEd BC and OneDrive. In addition, we are in the middle of refreshing all computer devices for Students, Teachers, School Staff and Board Office staff. The next logical step is to develop processes and supports to encourage and facilitate the adoption and effective usage of our District technologies.

A key goal for the coming year will be to consolidate all existing training resources into a unified site for all employees. In addition, we will develop new training materials specifically related to new technologies including Windows 10, Office 365, specific business-related applications, and educational applications.

Continuation of School Based Tech Plans

For the past several years, the District has been working with each school to develop their own Ed-Tech plans. The purpose and benefits of school-based tech planning include increased teacher engagement, allowing for differences in tech maturity between schools, and better alignment with school and district education goals. School based tech plans have been completed by 65% of schools and we expect all schools will have a plan within the next year.

Student Analytics

Three years ago, the District digitized the collection of student numeracy and literacy screener assessments. The former paper-based system was developed into a web-based internal application with the information stored in a centralized database in our Data Centre. In addition, the District has developed some rudimentary pivot table reports so that Teachers and Principals can quickly assess students progress and to develop numeracy/literacy learning strategies.

Over the next year, the District will expand on Student analytics and implement a student dashboard application called EdPlan Insight. EdPlan is a suite of tools and services that helps Educators quickly see the exact data that they need to develop personalized education for students. It is expected that this platform will enhance Educator’s ability to personalize student learning.

IT Governance & Defensible Security

The District has been working on best practices in IT, Risk Management and Defensible Security for several years. This work will continue over the next year and will specifically focus security processes, and IT Standards.

Business Automation

The District intends to automate several business-related workflows to gain better efficiencies in these areas and to improve overall service to employees. The following areas will be addressed in 1920/21:

Area	Workflow
Finance	Digitize and automate workflows around timecards, payslips, ROEs and T4s.
Human Resources	Develop automated workflows around employee onboarding, offboarding and movement between work sites.

1.1 Summary of Recommendations

The following is a summary of the key recommendations for actions contained in the Technology Plan.

Learning

- 1. It is recommended that the District continue to facilitate increased and equitable access to digital resources for teachers and students.***
- 2. It is recommended that the District continue to fine tune computer acquisition choices to ensure devices are function specific and that the best possible value is received from these purchases.***
- 3. It is recommended that the District set standards and develop approaches for teaching Digital Citizenship skills for students.***
- 4. It is recommended that the District ensure that there is equitable access for all students to digital tools and resources.***
- 5. It is recommended that the District ensure that communication and tracking tools are available to ensure that the goals of the Aboriginal Enhancement Agreement are realized.***

Assessment

- 1. It is recommended that the District continue the development of a model for learning assessment that includes ongoing gathering and sharing of data for continuous improvement of learning and teaching.*
- 2. It is recommended that through research, thoughtful inquiry, and collaboration inside and outside the district, the District design and develops student analytics and learning dashboards.*
- 3. It is recommended that the District continue with pilot projects for assessing and reporting on student learning.*

Teaching Practice

- 1. It is recommended that the District develop strategies for utilizing in-service and professional development to increase the technology capacity of educators.*
- 2. It is recommended that the District develop a common set of technology competency expectations for educators.*
- 3. It is recommended that the District undertake a one-time survey where teachers' and administrators' current technology skills are to identify where gaps exist.*
- 4. It is recommended that the District continue to collaborate with other Districts in the region with hosting an annual Innovate-Ed conference for educators.*

Innovation

- 1. It is recommended that the District continue to initiate, facilitate, and incubate practical research and pilot projects.*
- 2. It is recommended that the District develop approaches to measure the effectiveness of pilot projects, to ensure that lessons learned are communicated across the district, and to promote active dialogue regarding innovative practices around the district.*

Infrastructure

- 1. It is recommended that the District perform updates to their infrastructure annually.*
- 2. It is recommended that the District continue to implement G Suite, Office 365, and other cloud-based services to find better value for infrastructure, administration, and educational technologies.*
- 3. It is recommended that the District continue the development and adoption of single sign on technologies to integrate identity management services for enterprise applications.*
- 4. It is recommended that the District adopt a standardized, stakeholder-based process for analysing all core technologies to ensure that the best possible value is received, and that student's education is at the forefront of investments.*
- 5. It is recommended that the District base their computer device purchasing decisions on the specific end user functional needs for teachers, students, administrators, and board staff.*
- 6. It is recommended that the District develop an IT Risk Management plan that is inline with provincial Defensible Security guidelines and best practices.*

Administrative Technology

- 1. It is recommended that the new Accounting / ERP application be implemented in accordance with best practices and in line with the overall direction of Technology in the District.*
- 2. It is recommended that the existing web sites and related technologies be reviewed to ensure they are meeting the overall communication needs of the District.*
- 3. It is recommended that the District research the feasibility of providing WiFi access on school busses.*
- 4. It is recommended that the District develop strategies for utilizing professional development to increase the technology capacity of administrative staff.*

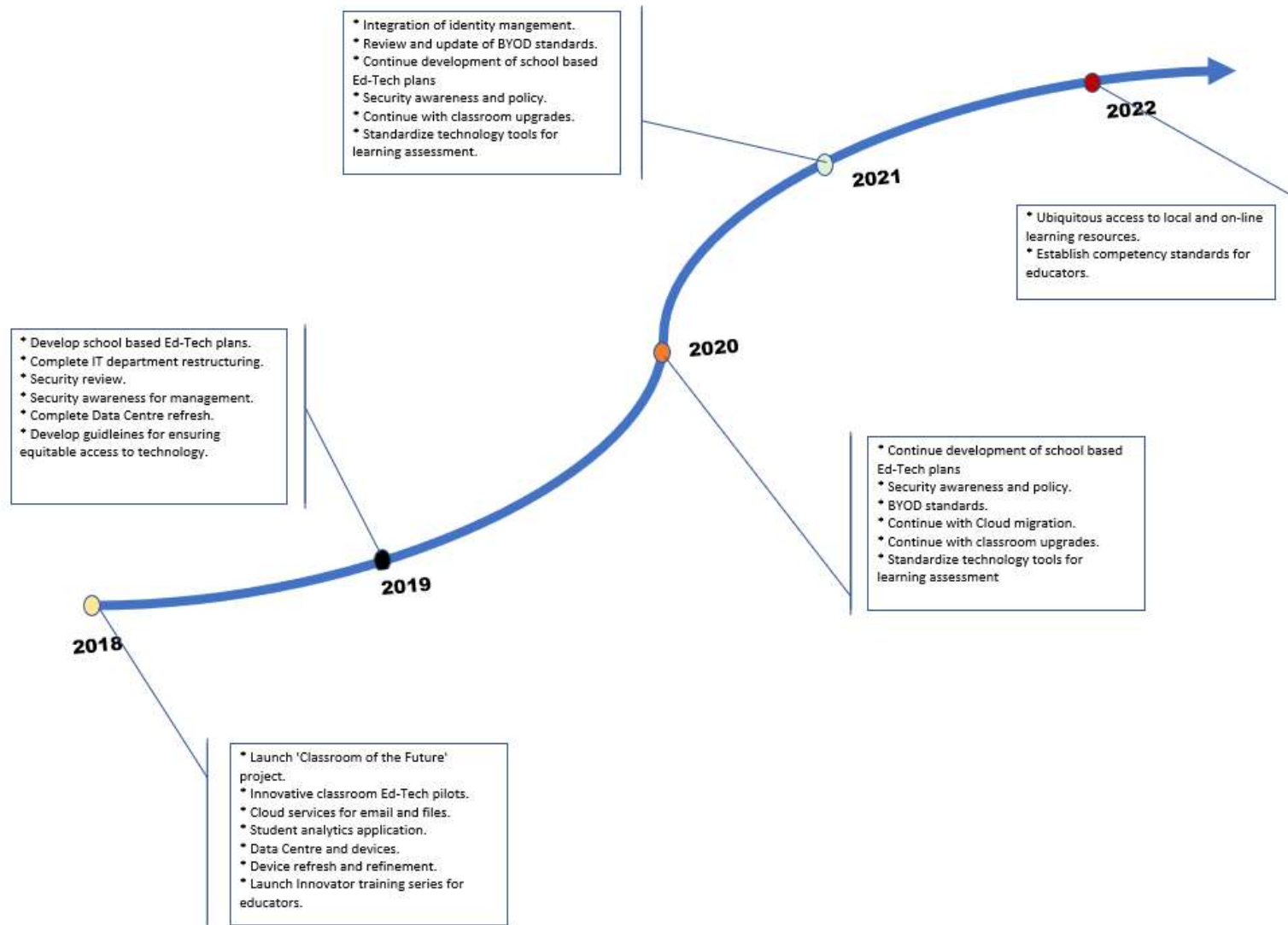
Leadership

- 1. It is recommended that the District continue with providing leadership in the IT area into the foreseeable future to ensure there is effective and strategic leadership.*
- 2. It is recommended that the District continue to investigate opportunities for shared leadership, and other shared service opportunities.*
- 3. It is recommended that the District work with appropriate stakeholders to develop school-based Ed-Tech plans to ensure that technology initiatives are directly connected to education.*
- 4. It is recommended that the District annually update the long-term technology plan.*

Resources

- 1. It is recommended that the technology department continue to be provided with an operating budget to support the ongoing operating costs and that the annual transfer of \$845,000 from operating to local capital continue for the technology and infrastructure capital costs.*

The following graphic provides a high-level view of the long-term Ed-Tech goals for the District as envisioned now.



2.0 - Introduction

Technology is a powerful tool and when implemented correctly, can radically transform learning. A strategic approach to technology investments and activities at School District 22 can significantly contribute to the advancement of the relationships between teachers and students. In addition, technology can facilitate the innovation of new approaches to learning, assessment, teacher development and collaboration.

We are currently continuing to evolve technology services through the lens of the district’s strategic plan and goals, school-based Ed-Tech plans, the BC Education plan, the new provincial curriculum, and the industries best thinking and research into the classroom of the future. Current technology infrastructure is rapidly evolving whereby devices are becoming more powerful and less expensive. Cloud services are presenting many viable (and better) options for hosting, data storage, and disaster recovery. BC’s Next Generation Network is providing opportunities for high speeds through their fibre-based network.

The purpose of this plan is to build on the District’s current shared vision for transforming our classrooms and educational practices. It is essential that the plan be directly linked with the School District’s current and future strategic plans. At the same time, transforming infrastructure, teaching practices and our classrooms is inherently a long-term endeavour and therefore this paper will map out a long-term plan that represents our best thinking at this time. The plan will suggest broad goals and actions that will move us in the direction of our shared vision. Of course, flexibility and agility are necessary traits in this age of rapid change. In keeping with this, we will treat this plan as a ‘living document’ and give ourselves permission to update and modify our ideas, as necessary.

2.1 Information Technology at School District 22: Current Profile

The IT department currently consists of six technicians and an IT Director. The department also has a high level of integration and communication with the Technology Innovation Coordinators (TIC) and other educators working in the curriculum area.

The department is responsible for managing, supporting, and implementing technology throughout the District including networks, servers, pilot projects, computing devices and applications.

The following table summarizes the key elements of technology infrastructure currently implemented in the District.

Schools & Board Office	Each building has server infrastructure to store data, manage device images, applications used for user authentication, and applications for classroom management.
	Each building has one or more physical wiring closets containing switching technologies, firewalls, and Telus equipment.
	Each building contains laptops, desktops, printers, networked photocopiers, and other computing devices for use by students, teachers, administrators, and clerical staff.
Data Centre	The District's primary data centre is located at Vernon Secondary school. The Data centre contains an array of servers, storage area network equipment, network equipment and backup technologies.
Secondary Data Centre	The District has a secondary data centre located in the Board Office. The data centre hosts servers for accounting, email, transportation applications and DNS services.
Cloud Platforms	The District has fully implemented Office 365 and G Suite which provide numerous educational and business applications and file storage space.
Staff	The IT department six technicians to implement and maintain technologies throughout the District.
	The District has employed the services of three (2.5 fte) Technology Innovation Coordinators (TIC) who are tasked with supporting and raising the tech capacity of teachers throughout the District. The TICs also help to facilitate Innovative pilot technology projects related to assessment and learning.

2.2 About This Plan

The primary purpose of this document is to develop, and continually refine, a long-term plan to ensure that technology in the District is directly connected to learning and assessment activities in classrooms. Working from a *Technology Plan Framework (See Appendix 'A')*, it addresses numerous Ed-Tech related questions that build on the existing vision and goals for technology.

In addition to the above 'broad' purpose, the long-term plan to focusses on specific Ed-Tech areas as follows:

Learning:	Includes curricular goals & activities, education software, access to technology, FOIPPA and safety.
Assessment:	Formative & summative assessment, assessment 'of' and 'for' learning, and analytics.
Teaching:	Transforming the classroom, building learning communities, capacity building.

Productivity:	Opportunities for shared services, enabling personalized learning.
Research & Development:	Initiating and facilitating pilot projects, fostering innovation, communication of results, continuous elaboration of a district vision and tech plan.
Infrastructure:	Analysis and planning for current and future infrastructure including device management, network, on premise services, off-site services, and disaster recovery.
Administration	All business-oriented technologies related to administration of the District.

This plan is broken into seven parts including sections on Learning, Assessment, Teaching Practice, Innovation (Research & Development), Infrastructure, Administrative Technology, and Leadership. As mentioned, it is critical that this technology plan reflect a District consensus on how to ensure that our technology services line up with curricular goals, and with activities in our schools and classrooms. The following are some overarching goals of this technology plan:

1. To formally assess how technology services in School District 22 link to current and future curricular goals and activities. From a technology standpoint, we need to determine where we are now and consider where we want to be in the future.
2. To ensure that the technology infrastructure has the capacity to support curricular goals, now and in the future. Also, to ensure that technologies are implemented with industry best practices in mind.
3. To ensure that technology supports the business needs of the organization. To assess current administrative technologies to ensure that they are cost effective, of a high quality, and meet the needs of the district.
4. To look at ways to improve productivity through technology, by challenging and revising learning and business processes. To ensure that educators in the District are fully supported and have professional development opportunities that will facilitate our building the classroom of the future.
5. To look at ways to improve cost effectiveness and quality of services by working with other districts and developing shared services.

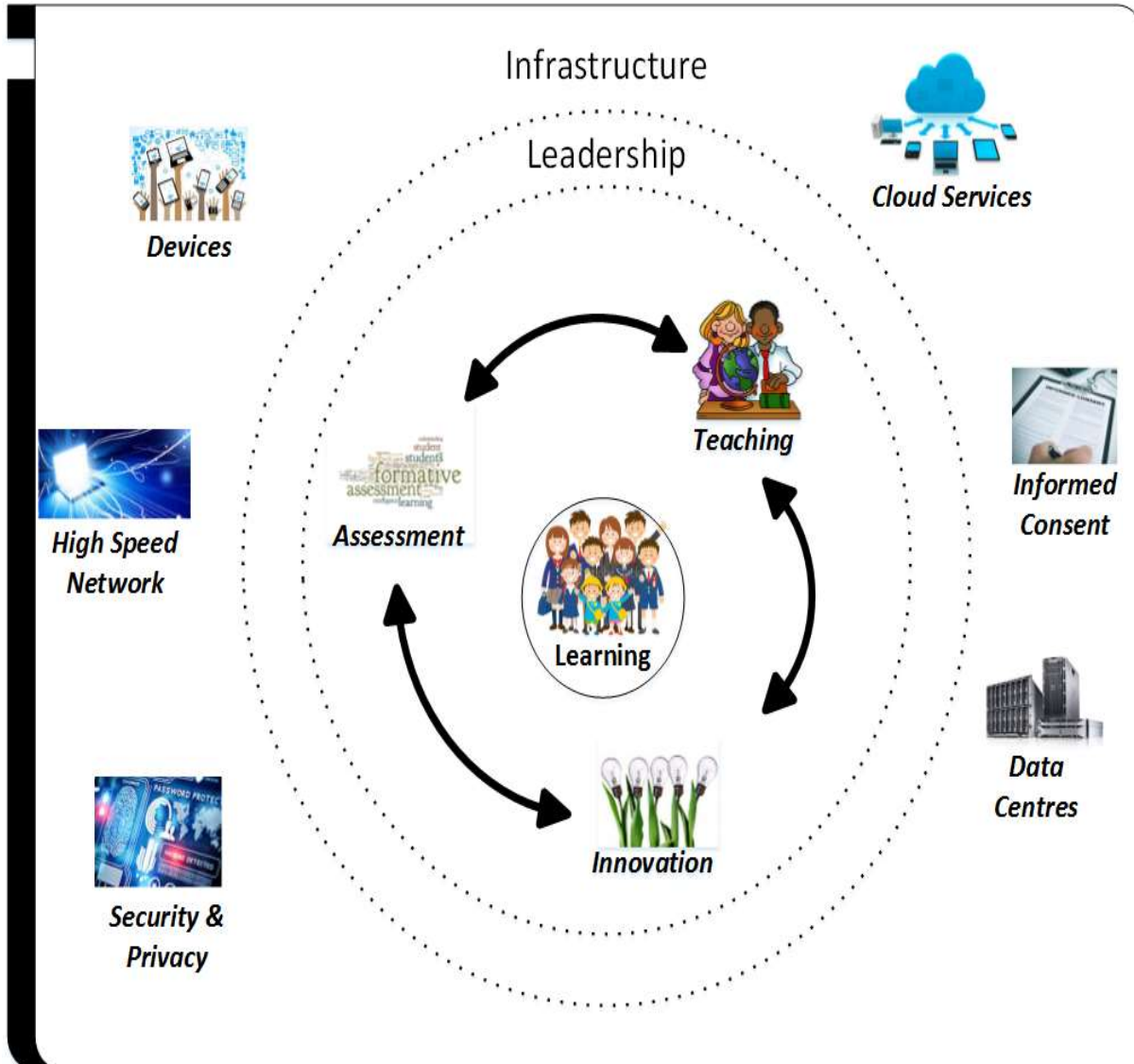
In conjunction with the goals suggested above, the following are suggested principles to keep in mind while going through the process of developing a long-term Tech Plan.

General Overarching Principles

1. Technical services, investments and initiatives should be derived from curricular activities, goals, strategies, and pilots. Technology should not be randomly adopted and then dictate or restrict education.

2. While the Tech Plan is a momentary static document, ideally there needs to be an on-going and agile process for ensuring that the Tech Plan can ‘live’ and evolve continuously in response to changes in philosophy and in the education environment.

Figure ‘A’ below depicts the relationships between the key elements of technology plan that is educational focussed and agile.



Next Steps for Ed-Tech Planning

The next step for Ed-Tech planning in the District is to work with each school and facilitate processes for developing individual plans for each school. This process will substantially broaden (educator) stakeholder involvement and ensure that plans are unique and relevant for each school. The following summarizes the desired outcomes for school-based Ed-Tech planning:

1. Ensure that Ed-Tech plans and investments are connected to school based curricular plans and goals,
2. To ensure that Educational Technology is connected to the Districts' Strategic plan.
3. To ensure that Educational Technology is connected to the Districts' Tech plan.
4. Ensure that that there is broad based, on-going educator involvement with Ed-Tech planning,
5. Ensure that culture, strengths, weakness, and opportunities are addressed within the plan for each individual school.
6. Raise the capacity of Educators in terms of understanding how Technology can be leveraged for student learning.

Goals

1. Develop a plan for technology needs for the next 3 years including learning activities that leverage technology, pilot projects and professional development.
2. Develop a plan for the appropriate infrastructure including network, wireless, teacher devices and student devices.
3. Ensure that there are appropriate school and district resources in place to realize the goals described above.
4. Ensure that school-based Ed-Tech planning process is on-going.

Suggested Process & Timeline

To ensure success for each schools Ed-Tech Plan, it will be critical to collaborate with a representation of appropriate stakeholders from within the school and within the District. The following is a summary of the suggested steps and timelines for school-based planning.

Step	Notes	Timeline
1. Recruit and organize school & district stakeholders to form your planning team.	This will include school admin, teachers, and the Technology Innovation Coordinator for your school, Tim and/or Luke.	ASAP. In time to update and replace devices and other technologies in your school.
2. With your planning team, review, discuss and document questions and analysis from the template.	Engage in other analyses and discussions as you deem necessary.	ASAP. In time to update and replace devices and other technologies in your school.
3. Review the plan with appropriate stakeholders to develop a viable plan to provide resources for the plan.	Incorporate all discussions and analysis into the plan.	ASAP. In time to update and replace devices and other technologies in your school.
4. Monitor and update the plan as required.		On going

3.0 - Learning

Outside of school, most students have ready online access to information and resources. They participate in social networks, collaborate with people from all around the world, share ideas, and learn new things. Students are free to pursue their own interests and passions in their own way and at their own pace. The challenge for education is to mirror this to create engaging, relevant, and personalized learning.

In the past, the question facing district decision makers has been whether technology should be used to help facilitate learning. Now, few dispute the need for technology. The important questions now relate specifically to 'how' to employ technology to help facilitate the highest possible educational experience for students. Researchers and educators have a significantly increased understanding of how people learn. As a result, this has paved the way to personalize learning and give students choice over what they learn, how they learn, and at what pace. This in turn will help to prepare learners to direct their own learning for the rest of their lives.

Over the past 7 years, the school district has made significant investments in technology infrastructure. These investments were made at a point in which most of the back-end technology services, network, and client devices were long overdue for replacement.

A technology 'refresh' plan was developed in partnership with IBM to replace servers, devices, and district wide applications. The technology refresh plan replaced approximately 2500 desktops and laptops. In addition, approximately 500 of the older devices were still functional and redeployed accordingly. Over the past 4 years, 2700 Chromebooks and 1100 iPads have been added to the student fleet of computing devices. This brings the overall total to 4500 student devices in the District. In addition, students have been provided with access to desktop resources, district wide applications, education related databases and other resources on premises and through the Internet. Other outcomes included the following:

- (i) The existing network infrastructure was completely updated with modern switches and routers.
- (ii) Physical network cable runs were replaced and/or augmented to raise the cable standard to Cat 6 and fibre where appropriate.
- (iii) A data centre was built in VSS to provide a variety of virtualized, Windows based enterprise applications to the district, provide file storage and backup, and provide a central management location for workstation images. The data centre was refreshed during the summer of 2018.
- (iv) Active Directory was implemented to manage security, user management and access policy throughout the district.
- (v) Email services were migrated to MS Exchange and Outlook. Email has now been ported to the cloud.
- (vi) SharePoint was implemented district wide to provide internal and external web services for all schools and for the School District in general.

- (vii) A new architecture was developed and implemented for creating and deploying workstation images and updates using Tivoli Provisioning Manager and APP-V.
- (viii) The District migrated to the new Provincial wide area network. The Next Generation Network (NGN) implemented fibre linkages to every school, the data centre and to the Board Office. The new infrastructure immediately increased individual site bandwidths and provided the platform for significant growth in bandwidth for future needs.
- (ix) Over the past year, the District has rolled out over 1,000 Chromebooks and 740 iPads for use by students. No computers were retired over this time, so the addition of these devices has substantially increased access to digital resources for students.

In addition to infrastructure investments, the school district has already made significant progress in terms of leveraging technology to transform learning. The following table provides a brief overview of progress made in several key educational areas.

Current Educational Technology Progress	
Leadership	Schools are engaged in the process of developing school-based tech plans to ensure that technology investments and activities are directly connected to education.
	A long-term Technology Plan was developed in collaboration with Teachers to create and implement a long-term vision that connects with education activities and curricular goals.
	The district hired a Director of Information Technology to lead the IT department, complete outstanding projects, connect the district's current and future technologies to education, and to develop strategies for implementing viable long-term leadership.
	School-based Ed-Tech plans are underway and/or completed in all schools. School based plans are resulting in increased teacher engagement, better alignment with district and school goals.
Kindergarten	The mobile Makerspace project includes a BeeBot (programmable robots) module to support learning through activities for letter recognition, sight words, phonological awareness, and spatial awareness. In addition to the above, kindergarten students are given access to early learning web-tools that support literacy development.
Early Learning	Primary grade students are given access to digital resources and web tools and applications that support the early learning goals providing personalized plans that can be scaffolded to the appropriate reading level of individual students.
Literacy	Students are provided access to digital resources and web-tools that help supplement the literacy goals supporting personalized learning plans at the appropriate reading level of the individual students
Numeracy	The robotics program provides students the opportunity to put math problems and concepts into action while learning spatial awareness and

	critical math principles that support numeracy outcomes. Students are provided access to digital resources, software and web-tools that help supplement numeracy learning goals providing the opportunity to personalize learning plans that are at an appropriate level of individual students. Students are provided access to Smart Technologies that provide hands-on learning activities to support the math learning objectives.
Aboriginal	Technology has been implemented in a way to express learning of Aboriginal content such as oral stories that can be shared through stop-motion videos, audio recordings and visual presentations. Share ideas and stories digitally widening the ability to easily access resources.
Social Responsibility	Students are provided access to digital resources such as EVERFI and MediaSmarts which raises awareness of Internet safety and further develops digital literacy skills.

Access to Technology

Students and Teachers will require increased levels of access to technology, and to on-line and on-premise resources. There are numerous shifts in the classroom than can be expected in the short term, medium term, and long term. These shifts include the following:

- i) Teachers will be expected to adopt technologies in their classrooms for content delivery, learner support, and learner assessment.
- ii) Teachers will be expected to gain and develop the skills required to adopt the technologies described above.
- iii) Teachers will be expected to collaborate with other teachers and professionals inside and outside their school and district.
- iv) Students will be expected to use a variety of technologies to socialize, organize, and engage in learning activities both formally and informally. This will occur during and beyond the traditional school day.
- v) It is expected that open educational resources (OER) will play an increasing role in the classroom.
- vi) As classrooms continue to evolve and shift, classroom pedagogies will include online learning strategies and increased collaboration in the classroom. Hybrid learning models will allow teachers to engage students in a variety of ways. 'Flipped classrooms' will facilitate group work and project-based activities during the day. Other learning activities such as reading, viewing educational videos, and consuming other content will occur outside normal classroom hours. This will effectively extend the learning day.
- vii) As students and teachers become more adept at integrating technology and learning, the opportunities for students to 'bring their own device' (BYOD) will become viable. Currently, Kalamalka Secondary, Fulton Secondary, and Vernon Secondary are piloting BYOD with students.

- viii) It is expected that traditional libraries will transform into a 'Learning Commons' for students and teachers. The idea of a learning commons is to create a shared space for information technology, remote /online education, tutoring, collaboration, content creation, meetings, reading, and study.
- ix) The traditional approach to computing device selection is best described as 'one size fits all'. This has led to significant over purchasing of computing power. It is expected that district-based device purchases will be based on the intended specific function. For example, students needing only access to the Internet require inexpensive light weight machines such as a Chromebook or Windows based mobile device. These devices are substantially cheaper than a traditional laptop.
- x) Both Google and Microsoft are providing inexpensive access to their core products for K-12 districts. It is expected that the District will implement a single sign on solution so that both Teachers and Students will have easy access to all relevant platforms including G-Suite (formerly Google Apps for Education -GAPE) and Office 365.
 - a. G-Suite is a core suite of productivity applications that Google offers to schools and educational institutions for FREE. These communication and collaboration apps include Gmail, Calendar, Drive, Docs and Sites, and a G-SUITE account unlocks access to dozens of other collaborative tools supported by Google. All these applications exist completely online (or in the cloud), meaning that all creations can be accessed from any device with an Internet connection.
 - b. Office 365 for Education is a collection of services that allows students and teachers to collaborate and share files. It is available under our current eDesktop licensing contract from Microsoft. The service includes online versions of Word, PowerPoint, Excel, and OneNote, and 1TB of storage in OneDrive.
- xi) Not all students have the same access to technology. Social and economic factors give rise to disparities between different groups and create a 'digital divide'. The District needs to continue to be aware of this and to develop strategies to ensure that all students have equal access to the technologies that are facilitating learning in the classroom and at home

Improved Communication between Home and School

A technology enabled school and classroom will provide considerable opportunities for improving communications between home and school. The trends in this area include the following:

- i) There is a clear shift in education from reporting at a moment in time (snapshot) to reporting ongoing learning. There are several evidence-based reporting tools currently being utilized in the school district including FreshGrade and MyEd. It is expected this type of reporting will become the norm in the future.
- ii) Numerous other informal communications can be facilitated though discussion forums, hangouts, and the MyEd BC family portal.

Protection of On-Line Privacy

Digital Citizenship is the body of knowledge related to safe online behavior and includes security, privacy, personal information, use of photographs, digital property rights and protection from viruses and malware. Digital Citizenship is a way to prepare students for a society full of technology. Digital citizenship represents the norms of appropriate and responsible technology use. It is expected that districts will need to set standards for students and teachers to articulate and set policy to define and govern appropriate use of technology, and for the protection of personal privacy.

Aboriginal Education

The Aboriginal Education Enhancement Agreement has been developed to continually improve the quality of education for all Aboriginal students, to support collaborative relationships between Aboriginal communities and school districts, and to provide Aboriginal communities with greater voice in the education of aboriginal students. There are several goals set out in the agreement between the Aboriginal community and School District 22 as follows:

Goal 1: Increase Aboriginal student success through improving communication and understanding of the Enhancement Agreement in School District 22.

Goal 2: Increase the knowledge and understanding of the culture and traditions of Okanagan people and Aboriginal peoples for all students, parents, community members, and School District 22 employees.

Goal 3: Aboriginal students will believe in themselves and be proud of their Aboriginal heritage and identity.

Goal 4: Aboriginal students will have a strong vision of who they want to be.

Communication

There are several areas where technology can assist in realizing these goals, particularly in communication. For example, video conferencing tools can be used to help bring stakeholders within the Aboriginal working group together for interactive meetings and other collaborative activities. Web based technologies can also be used provide an on-line space to share information, host discussions and share ideas to facilitate this.

Bridging the Digital Divide

A digital divide means that there is an uneven distribution in the access to, use of, and knowledge of information technologies amongst several distinct groups. These groups may arise due to economic and/or geographical factors. The District would like to explore ways to help bridge these gaps where they exist. The District will explore ideas such as pre-paid data plans and piloting Wi-Fi on bus routes.

Tracking Progress

One of the key administrative tasks for managing this agreement is tracking the work and activities of Teachers and Aboriginal Support Workers. It is key to the success of the agreement that these on-going activities and contact with students be tracked in detail for formal and informal reporting purposes.

3.1 Recommendations for Action: Learning

Overall, the mission of the Vernon School District is ***to inspire and develop lifelong learners who can communicate, think creatively, problem-solve, collaborate, and understand their personal and social responsibilities.*** The recommendations in the plan reflect this and are consistent with the District's vision of ***supporting a safe, healthy, and respectful learning community that enables each student to build a bright future.***

- 1. It is recommended that the District continue to facilitate increased and equitable access to digital resources for teachers and students.**

There is a proliferation of Internet and Cloud based resources and services that are relevant for K-12 education. These include web-based applications, digital resources, open source resources, services such as G-SUITE and Office 365.

- 2. It is recommended that the District continue to fine tune computer acquisition choices to ensure devices are function specific and that the best possible value is received from these purchases.**

The current average cost of a computing device is approximately \$1100 for devices that are quite powerful. Often, these devices are used for simple internet access and word processing. There is a new generation of extremely inexpensive devices that range in cost between \$200 and \$700 that will meet the needs for this type of use. As the District matures in their use of technology in the classroom, approaches and policies for BYOD can be developed.

Computing device acquisitions need to simultaneously consider functionality, affordability, and manageability to optimize value and efficiency.

- 3. It is recommended that the District set standards and develop approaches for teaching Digital Citizenship skills for students.**

It is critical that teachers understand and impart to students why it is important to address the 21st century skill of digital citizenship whereby students connect, collaborate, and communicate responsibly and safely. Both on premise and web-based resources can be utilized for this effort.

4. **It is recommended that the District ensure that there is equitable access for all students to digital tools and resources.**

Strategies for the equitable use of District resources can be developed to ensure that all students have access to digital resources.

5. **It is recommended that the District ensure that communication and tracking tools are available to ensure that the goals of the Aboriginal Enhancement Agreement are realized.**

A tracking tool could be either purchased or developed to ensure that internal and external reporting needs are met. The use of existing tools could be utilized for assisting the Aboriginal Enhancement working group can meet and collaborate on a more frequent basis.

4.0 - Assessment

Assessment plays an important role in student achievement. Assessment is the process of gathering evidence of what a student knows, understands, and can do. It can also help to identify students' learning needs. To make these assessments Teachers must rely on numerous inputs including their insights, knowledge about learning, and experience with students, and prescribed learning outcomes.

There has been much discussion in recent years regarding the use and effectiveness of different types and approaches to student assessment. It can be expected that technology will play an important role in supporting current and future types of student assessment. Current research (see Bibliography) in this area includes the following observations:

1. *Districts and schools need new and better ways to measure what matters; diagnose strengths and weaknesses of students; involve multiple stakeholders in the process of designing, conducting, and using assessments.*
2. *Student-learning data can be collected and used to continually improve learning outcomes and productivity. For example, learning data could be used to create a system of interconnected feedback for students, educators, parents, school leaders, and district administrators.*

Methods of Assessment

At present, primary approaches to assessment in BC Districts are based on tests and letter grades that are predominantly summative in nature. In addition, there are numerous standardized tests including PSA's, provincial exams, and other assessments that provide a snapshot in time. In general, the goal of summative assessment is to evaluate student learning at the end of an instructional 'period' by comparing it to some standard or benchmark.

There is a clear shift however to incorporating increased levels of formative assessments for students. The goal of formative assessment is to monitor student learning to provide on-going feedback that can be used by teachers to improve their instructional practice. Formative assessments can also be used by students to improve their learning. In general, this type of assessment can help students identify their strengths and weaknesses and target areas that need work. Teachers can identify where students are struggling and address problems immediately. In BC, assessment of student learning is undergoing profound change in sync with profound changes in the new provincial curriculum, and BC's Education plan.

Technology and Assessment

While the focus on student assessment is not new, the instructional technology tools to help implement meaningful assessment and feedback are. Modern technology offers educators a variety of new tools that can be used in the classroom. Technology can help teachers track and assess their students' progress, as well as their own. It can also be used to facilitate communication between students, teachers, and parents and to create digital records of student growth and development that can easily be passed along from grade to grade.

School District 22 will be implementing standards-based assessment and reporting using the newly implemented MyEd BC gradebook and reporting module.

Other ideas, observations and shifts that have come through discussion with educators in our District , and other research, can be summarized as follows:

- i) Assessments delivered using technology can provide a complete and more comprehensive picture of student needs, interests, and abilities as compared to traditional assessments. This allows educators an opportunity to personalize learning.
- ii) Student dashboards can be developed and implemented to provide the real-time feedback described above and allow teachers to take more immediate action. Families can be better informed about what and how their children learned on any day.
- iii) Technology has the potential to move assessment from disjointed separate measures of student progress to an integrated system of assessments and personalized instruction to meet the needs of the learner. Technology can integrate more fully student classroom experiences, homework assignments, and formative and summative assessments, all of which are tied closely to academic standards.
- iv) The use of ePortfolio is currently being 'piloted' in the district. This trend is expected to continue into the foreseeable future and will set the stage for defining the standard for the District.
- v) There is clear evidence that centralizing student assessment information from disparate sources including external tests, internal standardized assessments, student information systems and learning management systems will provide a much deeper look into student learning. Currently,

the school district is mapping out the details on how to centralize and display this information to discover patterns and learning preferences and to store this over time. Next year, the District will implement EdPlan Insight which will provide functionality to meet these needs.

4.1 Recommendations for Action: Assessment

The recommended overall goal is to develop assessment technologies and systems that will leverage the power of technology to measure what matters and use assessment data to improve learning. The following are specific recommendations in this area.

- 1. It is recommended that the District continue the development of a model for assessment that includes ongoing gathering and sharing of data for continuous improvement of learning and teaching.**

This will require the design and implementation of processes for the integration of data from disparate sources. This also implies that we continue with practices and events that increase the capacity of teachers, and other education personnel, to understand and design assessment strategies.

- 2. Through research, thoughtful inquiry, and collaboration inside and outside the district, design and develop student analytics and learning dashboards.**

The District currently has the technologies to store, manipulate and analyze student data. Our server infrastructure and web technologies will allow for reliable storage and access to this information year over year. Web technologies currently implemented will allow for analysis and display of relevant student analytics. The biggest challenge facing the district is to develop appropriate business processes for collecting and inputting data, and for formulating relevant questions to inform teaching practices.

The District will explore implementing EdPlan Insight and MyEducation BC Analytics to develop student dashboards and other reports. The District will also look at integrating our current analytics data with EdPlan Insight.

- 3. It is recommended that the District continue with pilot projects for assessing and reporting on student learning.**

The next step in assessment related pilot projects will be to determine the viability of these technologies and make recommendations for standardizing the use of ePortfolio tools for the future.

5.0 - Teaching Practice

Over the past 25 years, the world has changed faster and with more complexity than ever before. The most significant driving force is the advent of the Internet and the rapid advancement of technology as part of the digital age. Such a radical global transformation has demanded people learn new theories and knowledge that simply did not exist two decades ago. We need to find ways to evolve K-12 teaching approaches that are in sync with the evolving technological changes and competencies.

Building Teacher Capacity

Technology offers the opportunity for teachers to become more collaborative and extend learning beyond the classroom. Educators can create learning communities composed of students, fellow educators in schools, outside experts, and a myriad of external educational resources. Technology can be implemented to access after-school programs, experts from around the world in all disciplines, and members of community organizations.

The availability of technology-based learning tools gives educators a chance to be co-learners alongside their students and peers. Educators cannot be expected to know everything in their disciplines. On the other hand, they can be expected to know and model how to leverage available tools to engage content and access other learning resources.

To realize this vision, the District will need to support teachers in accessing needed technologies and in learning how to use it effectively. They will also need continuous, just-in-time support that includes professional development, mentors, and informal collaborations.

G-SUITE Summit and Ongoing Ed-Tech Conference.

The district hosted a G-Suite Summit in the fall of 2016 and approximately 125 teachers from Vernon attended. The event also attracted individuals from other BC school Districts. The two-day high-intensity event focused on deploying, integrating, and using G-Suite (and other Google tools) to promote student learning in our classrooms.

The summit also served as a springboard for developing an annual regional Ed-Tech conference in BC. In the fall of 2017, the District planned and hosted the first annual Innovate-Ed conference in collaboration with other school districts in the region. The conference attracted 436 attendees including 187 from the Vernon School District. Hosting an annual Ed-Tech conference in BC will continue to provide an affordable, ongoing option for Teachers to raise their technology awareness and capacity. In the fall of 2018, the event was hosted by the Kelowna SD and attracted approximately 600 attendees. In the fall of 2019, the event was hosted by the Okanagan-Skaha SD. In the fall of 2020, the event will be hosted again in Vernon.

Model for Connected Teacher

Educators can collaborate far beyond the walls of their schools. Through technology, educators are no longer restricted to collaborating only with other educators in their schools. They now can connect with other educators and experts across their communities or around the world to expand their perspectives and create opportunities for student learning. They can connect with community organizations specializing in real-world concerns to design learning experiences that allow students to explore local needs and priorities. All these elements make classroom learning more relevant and authentic.

Other ideas, observations and shift that have come through discussion in our District, and other research, can be summarized as follows:

- i) *Developing the capacity of educators needs to be compelling for teachers. Essentially, this means that educators need to see the endeavour is useful. Teachers need to be attracted to the approach as opposed to the approached being promoted.*
- ii) *Raising the capacity of teachers will require awareness that some teachers still have considerable fear and misunderstanding of the nature and role of technology in education.*

Digital Transformation and COVID-19

The world is deeply involved with Digital Transformation and this is especially true in the Education Sector. While School District 22 has made significant progress in this area, we still have tasks to do to keep us moving forward. Perhaps the best way to describe our current status is that we are very well equipped now with Technology but only *partially adopted and partially understood (Gura 2018)*.

The outbreak of COVID-19 has presented our District with numerous educational challenges which has included the need for rapid adoption of digital tools and technologies. The District has risen to this challenge very well. The silver lining with our present situation is that we have been forced to adopt digital platforms such as Office 365 and G-Suite, digital resources, and collaboration tools. We have very quickly ‘flipped’ the classroom, and this will help to further facilitate personalized learning. We know for sure now that we can all successfully leverage technology for learning.

In 2020-21 the District will continue its digital transformation journey armed with the positive outcomes from the COVID crisis and allow us to continue our focus on elevating the *adoption* and *understanding* of digital tools.

5.1 Recommendations for Action: Teaching Practice

The recommended overall goal is to ensure that educators will be supported, and professionally developed in a way that will allow them to leverage technology to connect to people, data, content, expertise, learning experiences and other resources. With this support, it is expected that teachers will be empowered to provide more effective teaching for all learners. The following are specific recommendations for this area.

1. **It is recommended that the District develop strategies for utilizing in-service and professional development to increase the technology capacity of educators.**

The purpose of professional development is to raise the capacity of teachers to improve their overall ability to use technology inside and outside the classroom. In turn, this will enable them to create compelling educational activities that improve learning and teaching, assessment, and instructional practices.

2. **It is recommended that the District develop a common set of technology competency expectations for educators.**

Like all school districts, there is a considerable difference in the Ed-Tech skills that teachers bring to the classroom. These differences relate to different formal education backgrounds, different philosophies, and different levels of experience with technology. While levelling the technology competencies is a long-term task, articulating expectations now can help teachers better understand where gaps exist and how to set about closing these gaps. Common technology competencies can also be used to communicate and provide input into post-secondary institutions where teachers are educated.

3. ***It is recommended that the District undertake a one-time survey where teachers' and administrators' current technology skills are to identify where gaps exist.***

This process will assist in determining what types of professional development activities are needed for teachers to better utilize technology for instructional practices and assessment. This will inform the District for developing strategies to create professional development activities.

4. ***It is recommended that the District continue to collaborate with other Districts in the region with hosting an annual Innovate-Ed conference for educators.***

Professional development is an inherently difficult and expensive proposition. Many high-quality conferences are in the USA and this severely limits the number of teachers that can be exposed to this type of development. At the same time, with changing education approaches, changes in assessment and ongoing changes to technology, there is a very high

demand for quality professional learning opportunities. This is an issue for all Districts in Canada.

The Innovate-Ed conference has provided an opportunity for educators in the Vernon School district to access training and to collaborate with peers. Last year, the registration fee for Innovate-Ed was \$75 which represents a very low cost for a high-quality event.

6.0 Innovation (R & D)

While Canada's education systems are among the best in the world, there is still a need to engage in practical research and to develop innovative ways to do better. There are significant and widespread changes going on in BC Education including; a clear shift towards developing personalized learning approaches; a comprehensive vision for the future of education in BC as articulated in the BC Ed plan; a new provincial curriculum to give teachers the flexibility they need to personalize their students' learning experiences; and changes to approaches to student assessment.

Much of the changes that are occurring within the BC education system have been articulated at a high level and without specific approaches for changing instructional practices. There is no instruction manual on how to move personalized learning from concept to everyday practice. As a result, districts, schools, and educators will need to innovate to move personalized learning from concept to the classroom.

In School District 22, we are currently sponsoring numerous innovative projects that relate to shifting instructional approaches, and to assessment. As the district progresses in this area, it will need to continue to develop a culture of innovation and allow educators opportunities to explore new ways to deliver education. To increase the visibility of all pilot projects in the District, it is recommended that the District host an annual showcase to share results and collaborate with stakeholders.

In support of facilitating and encouraging innovation, the province of BC has developed **the K-12 Innovation Strategy**. This endeavor has been designed to help and encourage teachers as they develop successful approaches that move personalized learning from concept to everyday practice. The heart of the strategy is the K-12 Innovation Partnership, which will be a community of practice focused on bridging the theory and practice of personalized learning. The partnership will be composed of identified schools from throughout the province that are interested in developing new approaches.

In the spring of 2016, School District 22 and the Technology Innovation Coordinators were recognized by the Partnership for their implementation of STEAM activities through the 'mobile makerspace' project. In addition to providing technology support for all teachers in the District, this same group has implemented numerous innovation practices including Breakout EDU, developing

approaches for adding computer coding to course curriculums, and participation in the global Hour of Code event.

6.1 Recommendations for Action: Innovation

The overall recommended goal is to continue to develop a healthy culture of innovation in the school district, to continuously analyse the success of these projects, and to adopt practices emanating from these projects where appropriate. Specific recommendations for actions include the following:

- 1. It is recommended that the District continue to initiate, facilitate, and incubate practical research and pilot projects.**

The District is well on its way for developing a healthy innovative culture that encourages exploration, development and learning of new and innovative ways to deliver education, and to assess learning. This culture will also help to develop and operationalize formative assessments, and approaches to embed assessments into everyday classroom activities. The work of the ***Technology Innovation Coordinators*** has been extremely successful for supporting Teachers and for initiating and facilitating innovative practices throughout the District.

- 2. It is recommended that the District develop approaches to measure the effectiveness of pilot projects, to ensure that lessons learned are communicated across the district, and to promote active dialogue regarding innovative practices around the district.**

Measuring the effectiveness of a pilot project is largely uncharted territory, especially considering that it is difficult to come up with objective measures. Notwithstanding this, approaches through discussion, collaboration, and qualitative analysis will need to be developed to determine the long-term viability of learning approaches and assessment that are being trialed in pilot projects. Currently there is a registration process in place that requires the sponsor of the pilot to develop metrics for determining the effectiveness of the project.

7.0 - Technology Infrastructure

IT infrastructure refers to the composite of hardware, software, network resources and services required for the existence, operation, and management of an enterprise IT environment. It allows an organization to deliver IT solutions and services to its employees and students.

IT infrastructure consists of all components that together play a role in overall IT service delivery. In addition to hardware and software, infrastructure also includes the people and processes that deliver IT services. Preparing students to be successful for the future requires a robust and flexible learning infrastructure capable of supporting new types of engagement and providing ubiquitous access to the technology tools that allow students to create, design, and explore. The essential components of an infrastructure capable of supporting transformational learning experiences include the following:

Ubiquitous Connectivity: To prepare for the future, all schools and classrooms require persistent access to high-speed Internet in schools. During the District’s refresh project all physical cable runs were brought up to Category 6e standard. In addition, the District’s switches and wireless infrastructure were updated and will meet current and medium-term needs.

In the fall of 2015, the district migrated to the province’s Next Generation Network (NGN). After the implementation, all schools and the Board Office were connected to province’s new high speed, fibre based wide area network (WAN). This architecture will allow bandwidth expansion into the foreseeable future as our needs change. During the spring of 2017, the NGN was updated which resulted in increased bandwidth in all our secondary schools. In the spring of 2019, the NGN was upgraded again to provide more efficient network services and higher security levels.

It is expected that the demand for online and/or cloud services will increase substantially in the future. With this increased demand, the weak link will be with our wireless infrastructure, and with our current contracted level of bandwidth at schools. With this, we will likely have to increase our bandwidth levels in schools by contracting for increased bandwidths as required.

Powerful Function Specific Learning Devices: Students, Teachers and other district staff require devices that connect them to desktop and enterprise applications, on premise services, and to the vast resources of the Internet. They are also used to and facilitate communication and collaboration. At present there is a relatively homogeneous fleet of computers and workstations in the District. Most of computing devices (workstations, computers, servers) are Lenovo as well as some legacy Dell computers. Most of the devices came because of recommendations contained in the IBM Technology Refresh plan, and range in price between \$750 and \$1,300 per unit (not including servers).

There is a broad range of computing requirements throughout the district. In general, there are some groups who have very ‘light’ computing requirements, some who have ‘average’ requirements

and of course those that are high end users and require considerable computing power. In the future, it is expected that the District will move to a much more heterogeneous environment whereby the computing device deployed will closely match the intended purpose and function. With this approach, it is expected that the average cost per device will be considerably lower than it is today.

Bring Your Own Device (BYOD): There has been much talk over the years about the possibility of students using their own devices in the classroom. This would increase the ratio of computers to students and allow learners more ubiquitous access to digital resources. This is a desirable outcome and would be economical in terms of the overall investment in technology infrastructure. At the same time, there are some obstacles to BYOD as follows:

- i) For the most part, teachers are not ready for a classroom consisting of a large mixture of computing devices. It can be very difficult for teachers to manage learning experiences and activities when they must support multiple platforms and device types, and some activities may be incompatible with some devices.
- ii) The district will need to develop processes, safeguards and /or implement mobile device management to ensure that acceptable use guidelines are adhered to, personal data is protected, and other virus and malware issues are managed.
- iii) Schools will have to be aware of potential economic disparities whereby not every student can afford their own device. Strategies will have to be developed to ensure that all students have equal access to on-line and on-premise resources.

On Premise vs Cloud Services: For the most part, all the districts applications and or services reside on desktops or on servers in one of the District's data centres. The following table summarizes the key applications and services that the District currently provides.

Data Storage	Historically, student & employee data has been stored on local school servers. Board office files are stored in the Board Office data centre and the VSS Data Centre. At present, file storage is being migrated into OneDrive, a Microsoft cloud-based service. This migration process will be completed in 2020.
Email Service	All District email services has been migrated into Exchange online, a Microsoft cloud-based service.
Classroom Management	The District currently uses School Connect; a product developed by IBM. The application is web based and runs on each school's local server. The application gives students and teachers the ability to create classes, drop boxes and other functionality to provide content and file

	storage.
Library Software	The district currently uses Insignia for tasks related to library management, textbook management, and resource centre management. The implementation of this cloud-based application was completed in 2020.
Student Information System	The district completed the conversion & implementation of its core Student Information System (SIS) from CIMS to MyEd BC. The system performs administrative and statutory tasks such as collecting student demographics, attendance, incidents, timetables, and a wide array of administrative and educational reports. The program also has classroom functionality including gradebook, assessment, and attendance. Licensing for CIMS software and hosting will be discontinued as at June 30, 2020.
Web Services / Portal	The district uses SharePoint and Scholantis for their district and school websites. The District is currently working with internal stakeholders and an outside vendor to refresh our external websites and our internal portals. This work is expected to be completed by Fall 2020.
Education Applications	Historically, most educational applications are installed on each individual computing device and managed through the districts Tivoli Provisioning Manager (TPM), APP-V to create, maintain and push out images. The District is in the process of replacing these tools with Microsoft Intune which provides similar device/application management. This cloud-based console will be used to manage all Windows 10 devices as these are rolled out across the District. The District also uses JAMF to manage mobile iOS devices and the G-Suite console to manage Chrome OS devices. The District has experienced a significant movement towards utilizing cloud-based applications. Many of these educational apps reside within the G Suite and within Office 365. This migration to web-based applications is an opportunity to move away from image-based applications which are difficult and time-consuming to manage.
Administrative Software	The District currently hosts most of their Administrative software on premises. There may be an excellent case to host some of these applications in the cloud to reduce costs, improve access, and to provide better disaster recovery options.
Disaster Recovery	In general, the cloud offers excellent opportunities for disaster recovery, business continuity, and file backup.

The hosting of applications and services will be considerably different in the future. There is a marked trend in all organizations to license applications and services that are hosted in the Cloud. Cloud services means technology services made available to users on demand via the Internet from a cloud computing provider's server, as opposed to being provided from a company's own on-premises servers. The idea with 'the Cloud' is that organizations contract with 3rd parties to store their data files, host applications, and provide other centralized services. The benefits to this

approach are economic (cheaper), ease of administration, ability to easily recover from disasters and well as providing access to files and services from anywhere.

Both Microsoft Office 365 and G-Suite have been fully implemented in the District.

- i. *G-Suite is a core suite of productivity applications that Google offers to schools and educational institutions for FREE. These communication and collaboration apps include Gmail, Calendar, Drive, Docs and Sites, and a G-Suite account unlocks access to dozens of other collaborative tools supported by Google. All these applications exist completely online (or in the cloud), meaning that all documents can be accessed from any device with an Internet connection.*
- ii. *Office 365 for Education is a collection of services that allows students and teachers to collaborate and share schoolwork. The service is available for all teachers, admin, clerical and board staff through our existing eDesktop licensing through ERAC. The service includes online versions of Word, PowerPoint, Excel, OneNote, a OneNote Class Notebook, and 1TB of storage in OneDrive.*

These are significant offerings from these organizations are and very compelling for school districts. The benefits of implementing these services are as follows:

- i. *Services described above are cost effective which makes them very compelling for Districts.*
- ii. *Both Google and Microsoft are offering 1 terabyte of storage for students and teachers. This means that as a district we can offer unprecedented levels of storage space that is extremely easy to manage. Specifically, this would reduce our need to store this data on premises which will reduce our costs for core storage and for backup. It will also remove a significant administrative burden of moving files around as students transition from grade to grade and school to school.*
- iii. *G-Suite is a fully hosted suite of education applications that is easy to manage and is very intuitive to use. Many teachers are piloting this service now and feedback has been very positive.*
- iv. *Microsoft's Office 365 is also a very compelling suite of applications and storage potential. All the key Office productivity applications are included and are highly recognizable to most end users.*

Single Sign On: Applications and tools can be configured to enable single sign-on—allowing teachers and students to log in to all their applications with a single password. A teacher teaching seven classes of students a day with multiple apps and tools needs a way to manage learning content, attendance, student progress, and grades. Students and teachers must keep track of a different username and password to log in to each system; this wastes time and creates frustration. For all these reasons, solutions involving single sign-on are needed for teachers and students to access all their applications through a single log-in credential.

Device and Server Replacement: Notwithstanding the major shifts occurring with hosting and data storage, the District still has a need to refresh their on-premise servers and devices on an ongoing basis. The Data Centre refresh was completed in July 2018. With the migration of file storage to the cloud, the functionality and cost of school-based servers will decline significantly.

As at April 2020, the District supports over 5500 computing devices. This is a significant increase from 4 years ago. The major reason for the increase is due to the rollout of approximately 3700 inexpensive Chromebooks and iPads. The age of the device fleet is as follows:

Device Age	Percent Composition April 2019	Percent Composition April 2020	Projected Percent Composition Dec 2020
New (1-3 years)	53%	73%	91%
Middle Age (3-5 years)	10%	24%	7%
Old (5+ years)	36%	3%	2%

The most efficient and effective way to refresh technology infrastructure is to do a little bit each year. This has the major benefit of spreading these costs over a longer planning horizon so that the District is not faced with a large one-time cost. The approach also has the benefit of allowing the district to continually modify the plan as technologies change year over year. This provides significant flexibility in terms of choice and cost of devices and servers, and whether to employ Cloud services.

The Classroom of the Future

Classrooms continue to evolve in concert with changes in instructional practices, assessment, teacher knowledge, and technology. In most recent history classrooms have been equipped with Wi-Fi, Smart Boards, computing devices, LCD projectors and other learning devices. The District has looked at the profile for the design and structure of the classroom of the future to match up with changes to learning and assessment.

IT Risk Management

Disaster Recovery & Business Continuity: Business Continuity refers to the continuation or resumption of technology enabled educational activities in the event of a natural disaster such as a flood, fire, epidemic or a malicious attack from the Internet. These are critical plans that involve the implementation of specific technologies as well as orchestrated procedures in the event of a disaster.

In conjunction with other district stakeholders, the IT department has developed a draft disaster recovery approach for specific disasters or technology failures. The exercise has identified several deficiencies including the need for off-site and off district storage, and the need to provide an alternative method of access the districts local network and the Internet in the event of catastrophic failure.

Approach to Risk Management & Defensible Security

IT risk is the organizational risk related to the use, ownership, and operation of Information Technology in the District. These risks specifically relate to events that could potentially impact the delivery of education. In addition, it is useful to understand that risks could relate to operational type things such as viruses, malware, disasters. They could also be related to compliance type risks such as FOIPPA, informed consent, and best practice standards.

In addition to the specific ‘risk management’ tasks identified above, it is proposed that a comprehensive approach be adopted for the analysis and response to potential IT risk events. Specifically, it is recommended the District adopt a recognized ‘best practice’ framework that is in line with the Provincial OCIO Defensible Security recommendations.

The analysis of all IT risks in the District, and planned responses to risk events should consider the following principles:

1. Risk analysis and responses need to be done within the context of the District’s strategic plan and educational goals.
2. Risk analysis and proposed responses need to consider the overall costs and benefits of the response.
3. All risks and planned responses need to be communicated across the District.
4. Risks and planned responses need to be continuously analysed and elaborated, as necessary.

7.1 Recommendations for Action: Technology Infrastructure

Overall, students, educators, administrative staff, and board staff will have access to a robust and comprehensive infrastructure when and where they need it for learning and other business and administrative tasks.

Specific recommendations are as follows:

- 1. It is recommended that the District perform updates to their infrastructure on an annual basis.**

Doing a little bit each year is more sustainable and affordable in terms of the overall investment in Information Technology. It also provides the District considerably more flexibility and agility to adopt and leverage new technologies as they occur for the betterment of facilitating education.

- 2. It is recommended that the District continue to implement G Suite, Office 365, and other cloud-based services to find better value for infrastructure, administration, and educational technologies.**

Both G Suite and Office 365 will continue to be offered to educators as viable platforms for digital classrooms, student learning and file storage. For administrative purposes, the district will

exclusively use Office 365 for e-mail, file storage, collaboration applications and other relevant cloud-based tools.

3. **It is recommended that the District continue the development and adoption of single sign on technologies to integrate identity management services for enterprise applications.**

Single sign on provides significant benefit to educational technology. It essentially means that students and teachers need only log-on once giving them access to hundreds (or more) applications related to their education. These applications would include the free services being offered through G-SUITE and Office 365. This offers considerable value and provides a choice for teachers to decide which tools best work for them in their instructional practice,

4. **It is recommended that the District adopt a standardized, stakeholder-based process for analysing all core technologies to ensure that the best possible value is received, and that student's education is at the forefront of investments.**

Technology infrastructure is extremely expensive to acquire and to implement. Due to these factors, it is very easy to get locked into specific technology decisions because of the significant barriers to implementing new applications and services. Notwithstanding this, it is a key success factor that technology be rooted in education and to be of high value. Therefore, the District should be always on the lookout for finding better, less expensive alternatives to serve education better. This approach would be adopted for all technology investments including educational software such as FreshGrade, G-Suite and Office 365.

5. **It is recommended that the District base their computer device purchasing decisions on the specific end user functional needs for teachers, students, administrators, and board staff.**

Devices are simultaneously becoming more powerful and considerably less expensive. The District should focus on purchasing 'just enough' computing power for the specific function that the device is intended to be used for. This will either reduce the overall cost of devices on the District, or increase the ratio of students to devices, or both.

6. ***It is recommended that the District develop an IT Risk Management plan that is in line with provincial guidelines and best practices.***

It is recommended that a comprehensive approach be adopted for the analysis and response to potential IT risk events. Specifically, it is recommended the District adopt a recognized 'best practice' framework that is in line with the Provincial OCIO Defensible Security recommendations.

8.0 - Administrative Technology

There are many technology services in the district that are primarily administrative in nature. While they support education activities in schools and classrooms, they are not directly linked to learning and/or assessment. Examples of Administrative technology include accounting systems, student information systems, device management applications, infrastructure technologies, IT support functions, and day-to-day business processes. Many administrative technologies are expensive to implement and support year over year. In many cases this is unavoidable. At the same time, they should be continually challenged, and consideration needs to be given to ways that we can do things better, and more cost effectively.

Board Office

Accounting

Currently, the District uses the SDS system for its General Ledger, Accounts Payable, Accounts Receivable, Human Resource, Payroll, Purchasing and other related functions. The system has performed well for the District and is well supported by the vendor. Like all ERP applications, the support fees are relatively expensive and cost the District approximately \$65,000 per year.

The vendor, Harris Systems, has notified the District that the SDS system as it presently stands will be deemed 'end of life' within the next several years. Although the vendor has indicated that the system will be supported into the foreseeable future, no further product enhancements will be released. They have however indicated that they will continue to update tax tables related to the payroll module and other related sub-ledgers.

The District has been reviewing potential alternatives to the replace SDS. It is expected that decisions regarding the product and implementation will be made within the next 2-3 years.

Cell Phone refresh

The District currently manages a cell phone fleet of approximately 110 units. In general, phones are issued to management and other employees where there is a need to have a cell phone. In the past, phones have been refreshed every 3 years regardless of condition or functionality. The overall experience is that the phones last 3-5 years unless there is specific failure with the hardware, or if the phone has been lost. Currently, the district is replacing approximately 30 phones per year based on a specific need for replacement. There does not appear to be any compelling reason to refresh cell phones until they stop functioning properly, or if they are lost.

The phones are issued specifically for priority and/or emergency situations and therefore their primary purpose is for phone calls and email. In some cases, district staff uses the phone to look at facilities drawings or other pertinent safety information. Staff may choose a more expensive phone and then reimburse the District for the difference.

Photocopier Refresh

In 2017-2018 the District underwent a detailed selection process for replacing their fleet of Kyocera multi function devices (MFDs). After this process, the District has purchased and implemented Konica-Minolta MFDs across the District. Schools and departments are charged for usage on a cost per copy basis. This cost includes a capital element which is transferred to local capital. It is expected that the process will save sufficient funds to replace the photocopiers when they reach the end of their useful life.

The District purchased the Paper Cut application which will provide complete transparency and manageability for all print devices. This will allow school principals and department managers to direct printing away from expensive print devices to relatively more inexpensive multi-function devices. The District is currently implementing Paper Cut at all locations.

My Budget File

The My Budget File application has been implemented by management to prepare annual budgets. The program uses a central database which makes it relatively simple for the Accounting department to roll up and consolidate budget estimates and analysis.

The budgeting process in the School District is comprehensive and is a major annual task for the Board Office and schools. It makes sense to have a centralized system to track and consolidate estimates for this task.

Student Information System

In December 2019, the District signed an MOU with the Ministry of Education to implement MyEd BC, the provincial common student information system. During 2019/20 the District implemented MyEd BC and is currently fully live with this application. Licensing for the Districts legacy CIMS system, and related services, will expire in June 2020 and will not be renewed.

System Gaps – MyEd currently does not have a fees module that will integrate with a banking system for accepting credit card payments from Parents for fees e.g. Transportation. The Ministry/Fujitsu will be implementing a system that will do this within the next year. In the meantime, the District will find an alternative tool for this task.

Student Files – The District's previous SIS (CIMS) had the functionality to store numerous types of digital artifacts related to a student. This functionality does not exist in MyEd. The District is currently working on a solution to download all existing files that are contain in CIMS and finding a new home to store and access these files.

Participation in Focused Education Resources

The District is a member of Focused Education Resources (formerly known as Educational Resource Acquisition Consortium (ERAC)). Focused Education Resources (FER) is a cooperative member-based organization. The group works in partnership with members who include BC public school districts as well as independent schools. The organization provides a range of services to its members that include evaluation, licensing and acquisition of print, software, and digital learning resources. At present, the District purchases Windows server and desktop licensing, Office 365 Licensing, access to learning / research databases, and several other enterprise-based desktop licenses.

Working as a consortium, FER can leverage better prices for learning resources, software, and videos. FER is funded through membership fees, an annual BC Ministry of Education grant and cost recovery fees for services performed on behalf of vendors or members. Overall, FER provides exceptional value to the school district.

Business Automation

The District intends to automate several business-related workflows to gain better efficiencies in these areas and to improve overall service to employees. The following areas will be addressed in 1920/21:

Area	Workflow
Finance	Digitize and automate workflows around timecards, payslips, ROEs and T4s.
Human Resources	Develop automated workflows around employee onboarding, offboarding and movement between work sites.

Maintenance

Work Order System

The District currently uses Web Works for managing work orders for maintenance and IT staff. The program has worked adequately for the past 10 years however currently it is somewhat outdated and has not been updated for several years. The Maintenance department is actively researching potential replacements. In 2019/20 the IT Department implemented their own work order system which more closely meets their needs.

Resource Information for Facilities Staff

As maintenance staff complete work at specific district sites, staff often need easy and quick access to site or situation specific information regarding technical and/or safety information. It would be beneficial for maintenance staff to have the ability to access site specific information, and other relevant resources, to assist them in their day-to-day tasks. To this end, the IT department is currently looking at hosting all this data on premises and developing a way to search and retrieve this type of information through cell phones and other mobile devices.

Telephones – Voice Over IP (VOIP)

The District uses a traditional analog telephone system with switches and wiring in every building and school. While this system is working adequately for the District, there is a growing trend in organizations to consider adopting VOIP to provide improved functionality and potentially a lower total cost of ownership. It is recommended that the District research the feasibility and business case for implementing a fully digital VOIP phone system.

Transportation

Routing Software – Transfinder and Traversa

Transfinder software has historically been used by the transportation department to optimize bus routes, allocate and manage students on routes, and manage field trips. This application has recently been retired and replaced with Traversa, which is a centralized system being offered by the province as a shared service. School District 22 has been piloting this software and to date the application has been working well.

ProFuel

The ProFuel program is used to help manage the department's fuel system. It is used in conjunction with the information gathered when drivers fuel up their busses / vehicle and to provide a variety of usage and efficiency information for the manager. The program is currently meeting the needs of the transportation department and no upgrades or enhancements are required at this time.

Zonar GPS

The Zonar program provides real-time tracking of bussing and other vehicles. The program is currently meeting the needs of the transportation department and no upgrades or enhancements are required at this time.

WiFi on Busses

The practice of equipping school buses with Wi-Fi is growing in popularity in many jurisdictions in both Canada and the USA. The idea is to essentially extend the classroom and provide students with access to educational resources while they are travelling to and from school. In terms of developing flipped classroom, the 'internet enabled' bus would provide time outside the classroom to access digital content, consume education related videos and possibly to video conference or chat with teachers. This would allow for more classroom time for project-based work, collaboration, and discussion.

The practice has met with success in many jurisdictions and has also led to diminished behavioral issues for drivers to deal with.

8.1 Recommendations for Action: Administrative Technology

In general, it is recommended that the District follow a disciplined and comprehensive process for making decisions regarding administrative technology. The process should be rooted in a proper business case approach that identifies the specific functional requirements first, selects vendors to do presentations based on their specific ability to meet the requirements, and then perform an analysis that weighs both qualitative and quantitative factors. To the extent possible, all relevant stakeholders should be included in the process and have significant input into the final decision.

- 1. It is recommended that the new Accounting / ERP application be implemented in accordance with best practices and in line with the overall direction of Technology in the District.**

The District has been reviewing potential alternatives to the replace SDS. It is expected that decisions regarding the product and implementation will be made within the next 2-3 years.

- 2. It is recommended that the existing web sites and related technologies be reviewed to ensure they are meeting the overall communication needs of the District.**

The District's school and central websites provide key communication services for stakeholders inside and outside the organization. It is important that the business needs and requirements be properly defined in this area and that the appropriate set of technologies be implemented to meet these communication needs.

The District is currently working with internal stakeholders and an outside vendor to refresh our external websites and our internal portals. This work is expected to be completed by Fall 2019.

- 3. It is recommended that the pilot the use of providing WiFi access on 1-2 school bus routes.**

Research should be performed to look at other School Districts that have implemented this technology and determine if educational goals were met. If there appears to be educational benefit, it would be worthwhile to look at the feasibility, costs and other factors related to the District wide implementation of the service.

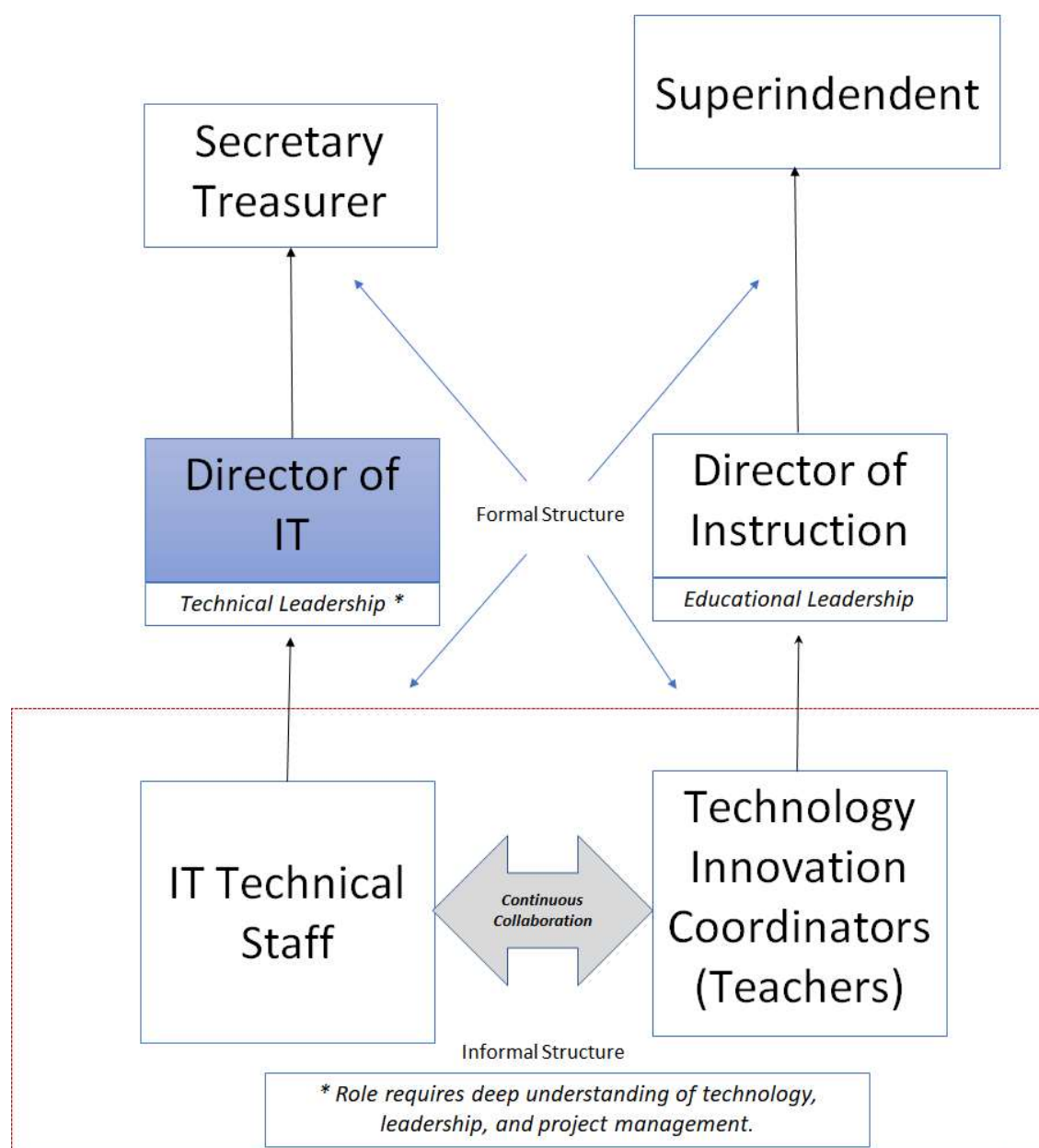
- 4. It is recommended that the District develop strategies for utilizing professional development to increase the technology capacity of administrative staff.**

The purpose of professional development is to raise the capacity of employees to improve their overall ability to use technology in a productive way.

9.0 – IT Organizational Structure

IT leadership in School District 22, and in most other school districts, is a business-oriented function to ensure that there is alignment between IT and the mission and goals of the District. This is a crucial role that requires a deep understanding of technology, leadership, and project management within an educational organization. The IT organizational structure in SD 22 is consistent with this description.

The following chart depicts the IT structure in SD22:



Education needs to be at the centre of all technology initiatives. In fact, there should not be any **Technology Initiatives** per se, only **Education Initiatives**. Every dollar that is spent with respect to technology should be demonstrably linked to education or to an education initiative. The only way to achieve this is to develop an intensive partnership and collaboration between Education and Information Technology activities in the district. The formal and informal organizational structure describe above ensures that this intense collaboration occurs in the District.

In addition to the above, there are several ways to ensure that both Education and Information technology work closely and effectively together. These can be summarized as follows:

- i. *Develop broad education stakeholder collaboration with respect to technology planning to ensure that all technology is rooted in Educational thinking and practice. Work with stakeholders at each school to ensure that there is appropriate collaboration and allowance for different needs and cultures.*
- ii. *Ensure that Information Technology leadership occurs at the senior level in the district to guarantee that there is a continuous and shared vision for technology, and that there is buy-in and communication at all levels.*

Just as specific technologies have rapidly changed over the past 25 years, so has the need for IT Leadership. Traditionally, IT has been managed by senior technical staff, teachers, principals, or by the business function in the district. With the current challenges, changes and complexities facing districts today, none of these approaches provides all the necessary skills and experience demanded of this position. IT departments require business level leadership to provide the appropriate balance and depth in the areas of leadership, technical savvy, and relevant experience to connect IT services to education.

In addition to getting things done in a cost-effective manner, the purpose of this role is to provide vision, leadership skills, team building and collaboration abilities, communication skills, and project management expertise. Above all, an IT leader needs the ability to understand and align technology initiatives with the districts' and regions' education goals and initiatives.

Effective leadership is an essential component of Educational Technology, administrative technology and for managing district infrastructure. The following are some benefits to having on-going senior leadership for the technology function in the district:

- i. *To ensure that all existing technologies (administrative and educational) are managed and maintained daily.*
- ii. *To ensure that projects are managed using recognized traditional and Agile methodologies.*
- iii. *To ensure that technologies are refreshed and budgeted for on an annual basis.*
- iv. *To ensure that district staff technology needs & issues are completed on a timely basis.*
- v. *To ensure that tech staff are properly trained and professionally developed for current and future technologies.*
- vi. *To ensure that technology projects are managed in an efficient, effective, and cost-effective way.*

- vii. *To ensure that there are tested plans for disaster recovery and business continuity.*
- viii. *To ensure that all technologies relate to education and education initiatives. Specifically, to implement the facilitating technologies related to school's strategic education plans.*
- ix. *To provide strong technical leadership throughout the District.*
- x. *To ensure that there is a continuous vision for technology and education for the future.*
- xi. *Raise the overall service maturity level of participating districts in response to internal and external expectations for security and privacy. This could be achieved through alignment with industry published industry standards including ITIL, ISTM and ISO 20000.*
- xii. *To provide a structured approach to initiating and managing IT projects that addresses change, implementation, and operation.*
- xiii. *Preparing and managing annual budgets for sustaining the IT function.*
- xiv. *Develop relationships with external vendors and service providers to ensure high quality and cost-effective outsourced solutions (where required).*
- xv. *To build effective relationships throughout the District and education communities to remain current with educational initiatives in other jurisdictions, to remain current with all relevant technologies, and to ensure that the District can leverage all the above to their advantage.*

IT Department Restructuring

The IT department should be structured and organized in a way that will optimize the ability to manage and deliver IT services in the District, now and into the future. A strategically structured department will also allow for significantly improved communications and a consistent approach to all technology services across the District.

Department Restructuring

In 2018/2019, extensive restructuring was completed in the department to better align skill sets with the current and anticipated needs and technologies deployed in the District. The department is moving away from the 'Universal Technician' approach in favour of creating technology specialists that fit with the needs of the District and with staffs interests and aptitudes. The restructuring of the department was completed in May 2019.

Other IT Department HR Issues

There will be several issues that face the IT department in the coming years. These issues relate to expected retirements, skills gaps, alignment with shared services, provision of IT services in the event of a strike, and overtime. An approach for this restructuring is currently being developed and will have no immediate impact on the department's budget.

Shared Services

School districts are faced with ongoing challenges related to the overall leadership, investment, implementation, and management of Information Technology. These challenges are particularly true for small and medium sized districts. Technology has become extremely diverse and is increasingly relied upon by stakeholders throughout the organization. At the same time, technology has become more complex, specialized, and is ever changing. This leaves districts with insufficient resources to deal with these realities including budget shortfalls; service gaps; knowledge gaps for education, admin, and technical staff; and insufficient resources to raise the overall tech capacity of the district.

For the above reasons, it makes sense for small and medium sized Districts to develop and pursue shared services by collaborating with other Districts. The following are some compelling reasons for this:

- i. For many districts, there is insufficient knowledge or experience at the senior staff level to make fully informed decisions regarding the choice and ‘flavour’ of technologies. External vendors are often relied upon to fill the gap in this area, which is helpful, but not always in the best interests of districts/schools/students. This often results in one or more issues:*
 - a) Over investment in technology; this includes investment in the wrong technology, and / or too much investment in specific areas.*
 - b) Under investment in technology; this includes not enough infrastructure to handle the load and demands of the district and / or gaps and bottlenecks in areas that are critical to education.*
 - c) Undue reliance on outside vendors to perform a specific IT service.*
 - d) Not enough reliance on outside vendors where the nature of the technology and implementation make outsourcing a logical option.*
- ii. A significant proportion of IT work is involved with the initiation of new technologies and with managing the change that accompanies these implementations. Leadership and management of these tasks have evolved into a specific specialty known as ‘Project Management’. The benefit of professional project management lies with organizing, planning, and controlling tasks including the management of budget, timelines, risk, quality, and change.*
- iii. Our understanding of how children learn has led to new ideas on how to evolve our classrooms, and to personalize learning. Technology has a significant role to play in these changes; it is both the medium AND the message. IT departments need to keep up with changes to pedagogy to help facilitate the delivery of education. They also need to provide technology mentorship to educators so that they can reflect its rapidly changing nature in the classroom. It is critical that IT departments be in alignment with these educational changes.*

- iv. *Every two years the Auditor General of BC reviews and issues a report on a District's overall IT maturity level, and the controls that are in place to ensure confidentiality, integrity, and availability of IT systems. Many districts have not fared well with these reports and moreover, do not have the resources to address deficiencies. By pooling resources, districts can address these deficiencies and improve overall service levels. There is also a growing need to approach IT from a service perspective, and to structure and standardize this around industry frameworks such as ITIL, ITSM and ISO 20000. This will be specifically addressed in the planning stages for shared services.*

Shared Service Initiative in BC

In June 2015 district technology leaders convened in Richmond to discuss the potential for shared services. Many ideas and governance preferences were discussed and documented by the organizing group of Districts. What has emerged from this meeting is a concept paper to create a shared service organization entitled the **Technology Leadership Advisory Committee**. The purpose of the working group is to create a technology centric organization to share services and advance capacity for technology facilitated learning, and other administrative functions. The collaboration specifically addresses many areas of technology including knowledge sharing, policy making and advocacy, procurement, and technology development.

District 22 has been participating in the initial and follow-up meetings and believe that there is sufficient interest in this initiative throughout the province.

9.1 Recommendations for Action: Leadership

The overall recommended goal is to ensure that there is effective and strategic leadership of the IT function and to ensure that education is technology-enabled throughout the District.

- 1. It is recommended that the District continue with providing leadership in the IT area into the foreseeable future to ensure there is effective and strategic leadership.**

The leadership function should be tasked with day-to-day leadership of the IT department, managing infrastructure and Ed-Tech projects, facilitating communication and collaboration amongst internal and external stakeholders for all technology initiatives, and establishing relationships inside and outside, and ensure that technology investments provide strategic value. It is also critical that technology investments be sustainable, secure, robust, and cost effective.

- 2. It is recommended that the District continue to investigate opportunities for shared leadership, and other shared service opportunities.**

The District is currently participating in the province wide initiative - the *Technology Leadership Advisory Committee*. In addition, the district will continue to pursue opportunities directly with other districts, particularly in shared leadership

- 3. It is recommended that the District work with appropriate stakeholders to develop school-based Ed-Tech plans to ensure that technology initiatives are directly connected to education.**

As we progress as a District in this area, it can be expected that technology decisions will be transparent, rooted in education and enable personalized learning in and outside the classroom.

- 4. It is recommended that the District annually update the long-term technology plan.**

Technology plans need to be flexible and stakeholders need to be agile to ensure that technology initiatives are responsive to changes in education policy and practice. In an environment of rapid technological change, the District should be poised to leverage new technologies as they emerge in a way that benefits student education.

10.0 – Required Resources

Department Budget

The technology department is funded through the operating budget to support staffing costs and service and supply costs including software licensing, NGN network charges, and travel and training.

Technology / Infrastructure

The district currently annually transfers \$845,000 from operating to local capital to support the capital costs of refreshing of computing devices and back-end technologies. These transfers provide sufficient funds to maintain and improve our district technology and infrastructure needs expected over the next five years.

10.1 Recommendations for Action: Required Resources

1. It is recommended that the technology department continue to be provided with an operating budget to support the ongoing operating costs and that the annual transfer of \$845,000 from operating to local capital continue for the technology and infrastructure capital costs.

References

- Baker, D. B., J. T. Fouts, C. A. Gratama, J. N. Clay, and S. G. Scott. 2006. *Digital Learning Commons: High school seniors' online course taking patterns in Washington State*. Seattle: Fouts and Associates. <http://www.learningcommons.org>.
- BC Ministry of Education: BC Ed Plan: Focus on Learning, 2015. <http://www.bcedplan.ca/>
- BC Ministry of Education: Prescribed Learning Outcomes, 2011. <https://www.bced.gov.bc.ca/irp/plo.php>
- Bennett, R. E., H. Persky, A. Weiss, and F. Jenkins. 2007. *Problem solving in technology rich environments: A report from the NAEP Technology-based Assessment Project, Research and Development Series* (NCES 2007-466). U.S. Department of Education, National Center for Education Statistics. Washington, DC.
- Black, S. E., and L. M. Lynch. 2003. The new economy and the organization of work. In *The handbook of the new economy*, ed. D.C. Jones. New York: Academic Press.
- Brown, J. S., and R. P. Adler. 2008. Minds on fire: Open education, the long tail, and learning 2.0. *Educause Review*: 17–32.
- Brynjolfsson, E., and L. M. Hitt. 1998. Beyond the productivity paradox: Computers are the catalyst for bigger changes. *Communications of the ACM* 41 (8): 49-55.
- Collins, A., and R. Halverson. 2009. *Rethinking education in the age of technology: The digital revolution and schooling in America*. New York: Teachers College Press.
- Gray, L., and L. Lewis. 2009. Educational technology in public school districts: Fall 2008 (NCES 2010-003). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Gura, Mark. 2018. *The EdTech Advocates' Guide to Leading Change in Schools*. International Society for Technology in Education (ISTE).
- Leu, D. J., C. K. Kinzer, J. L. Coiro, and D. W. Cammack. 2004. Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In *Theoretical models and processes of reading*, 5th ed., 1570–1613. Newark, DE: International Reading Association.
- National Research Council. 2000. *How people learn: Mind, brain, experience, and school*. Eds. J. D. Bransford, A. Brown, and R. Cocking. Washington, DC: National Academies Press.
- OECD (Organization for Economic Co-operation and Development). 2008. 21st century learning: Research, innovation, and policy directions from recent OECD analyses. <http://www.oecd.org/dataoecd/39/8/40554299.pdf>.

U.S. Department of Education, Office of Educational Technology, Future Ready Learning:

Reimagining the Role of Technology in Education, Washington, D.C., 2016.