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Leicester Research A Study in Effective Technology in Education

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Leicester Public Schools Research

CAPSTONE

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Abstract

The LPS Research Team has been tasked with researching and recommending a technology plan for a new school that Leicester Public Schools is planning to build. In this paper, we present an overview of the our goals and our client's goals, an introduction to industry trends, and discuss our findings based on research conducted via interviews with schools that have undergone similar projects. We also outline the conclusions drawn from this research and our analysis of the data we uncovered, and make specific recommendations for technology to be utilized in Leicester's new school. Finally, we present a 3-part framework that Leicester Public Schools can use to refresh this data as needed, for this or future educational technology endeavors.

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The Leicester Public School (LPS) Research Team wishes to thank our Advisor Richard Aroian and our client Jeffrey Berthiaume for providing direction and assistance to us during our project.

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Introduction

Executive Summary

While the Leicester Public School (LPS) Research Team was researching information about technology in classrooms it became apparent that there are insufficient resources available to assist schools in identifying technology trends in their classrooms. While a good amount of information about technology and lots of sales resources exist, identifying unbiased opinions, student experiences and teacher experiences, vendor relationships, challenges with roll-outs, and expectations for the future are lacking or exceedingly biased.

This project was originally intended toward one school district in Leicester, Massachusetts to identify leading technology which was also well-tested and stable for the construction of their new elementary and/or middle school. With this project, not only have we identified many of these key issues for use in planning technology for a new LPS building, we have also created a framework to perform similar technology research projects in the future, to assist educators in identifying the best technology needs for their schools and districts.

Using our framework we inquired to multiple districts that had recently undertaken a full renovation, or installed a new school, or completed a technology upgrade project. We were able to get a data set consisting of seven school districts representing over 40,000 students in Massachusetts.

After analyzing our findings we came to a consensus from our research. Our consensus included the necessity of Google products as part of a complete solutions as their offerings are at such good value. Most schools found using Chromebooks beneficial to the students and services

such as Google Drive, Google Classroom, and other Google products are part of the norm for the students. Other findings include information on iPads which our research indicates are too costly for their benefits. The lack of a physical keyboard, lack of direct integration with Google services, and the lack of a leasing program or early replacement program cause these to be non-starters for many schools.

The recommendations of the LPS Research Team focus largely on Google Products such as Chromebooks, Google Drive, and Google Classroom. For the delivery of such devices we recommend leasing and having the foresight to add into non-capital budgets the ability to continue leasing as part of the rotation of devices, so the technology always stays current. We also recommend using smart projectors over smart whiteboards as our research indicates the lack of long-term support for whiteboards.

Background Information

Town of Leicester

Leicester is a town in the county of Worcester, Massachusetts, United States. Officially incorporated in February 1973, it has a total area of 24.7 square miles ("Leicester Massachusetts," n.d.). The current population of the town is about 11,000 of which 1,900 are school age with 26% of the population under the age of 18. More than 300 business are currently settled ranging from small business such as restaurants, farms, and nursing facilities to large organizations like Walmart and Tractor Supply Co. ("Living in Leicester," 2016).

Town Government is New England Town Meeting style with a Town Administrator managing the day to day activities overseen by a board of five selectmen ("Leicester Massachusetts," n.d.).

Leicester Public Schools

Public education in Leicester is composed of four public schools. Leicester Primary School (grades K-2), Leicester Memorial School (grades 3-5), Leicester Middle School (grades 6-8) and Leicester High School (grades 9–12) ("Leicester schools," 2018).

Mission

To promote student achievement and preparation for global competitiveness compelling students to communicate, problem-solve, use of technology, and collaborate effectively while creating meaningful products and exercising responsible citizenship in its quest to help students prepare for future endeavors ("Leicester Public Schools," 2018).

Vision

Recognized by the community as its greatest asset, Leicester Public Schools engages every child in rigorous and student centered learning in a safe and technology-rich environment (Leicester Public Schools, 2018).

Strategy

Leicester Public Schools has defined three strategic initiatives to enable their vision ("Three Year District Improvement," 2014):

- Engaging instruction and effective interventions grounded in a rigorous curriculum.
    - PK-12 curriculum and assessments aligned to standards.
    - Expanded curricular offering.
    - A system of interventions, support, and enrichment.
- Development of staff skills through effective feedback and training
    - Effective educator evaluation system.
    - Beneficial professional development.
    - Personnel system that attracts, recognizes, and retains faculty and staff.
- Improved infrastructure and resources
    - School facilities upgrades.
    - Sufficient allocation of financial resources.
    - Improved technologies access and use.

("Three Year District Improvement," 2014).

WAN Speeds at Leicester Public Schools over time

School	2013-14	2014-15	2015-16	2016-17	2017-18
High	30mbps	100mbps	300mbps	500mbps	500mbps
Middle	30mbps	100mbps	100mbps	200mbps	200mbps
Memorial	30mbps	100mbps	100mbps	200mbps	200mbps
Primary	30mbps	100mbps	100mbps	200mbps	200mbps

("Technology plan 15-18," 2015)

Student Device Ratio at Leicester Public Schools

School	Students	Devices	Ratio
High	460	460	1:1
Middle	424	280	~1.5:1
Memorial	334	280	~1.2:1
Primary	320	85	~3.8:1

The district currently has ~1.4:1 Ratio (1538 students, 1105 devices) ("Technology plan 15-18," 2015).

The charts shown above were part of technology plan for Leicester Public Schools with the most up to date information as of the writing of this document. We used this information for the basis of our some of our recommendations. Based on the goals of bandwidth the LPS Research Team deduces that the Leicester Public School district is dedicated toward continuous improvement. The LPS Research Team also have come to understand that the district is piloting

a program in 2018 for 1:1 student/device ratio in the middle school ("Three-Year District Improvement Plan for 2017-2020," 2017).

Statement of the Problem

Technological development and innovation impact everyday aspects of our lives and it is almost impossible not to use it at all. It has been very smoothly incorporated into business and private spheres, and finally it is apparent that it will impact the public domain, particularly education and schools. It brings a big hope and excitement about the potential for technology to transform teaching and learning. The goal is that technology will support schools and teachers to engage even more students in the learning process (Escueta et al., 2017).

Currently, schools and teachers can choose from a wide variety of technological tools - starting from digital platforms including computer assisted online courses to educational games. The technological boom also allowed schools to help their students to have access to technology at all. It is crucial especially if we would think about students from lower-income families where they may not be able to afford for computers or tablets. It allows them not to be marginalized and have a better start in the future (Escueta et al., 2017).

Even though the education technology market (referred to as Edtech the industry) is somewhat behind in comparison to other sectors, it can be noticed that there is a significant increase in investment in the Edtech market. In the United States, the market for the PreK-12 software alone had exceeded $8 billion according to the SIIA "*2014 U.S. Education Technology Report,* " (Bostrom, 2015). If we compare that data to the previous year's estimates there is an increase of 5.1% and 11.7% over the last four years (see Figure 1).

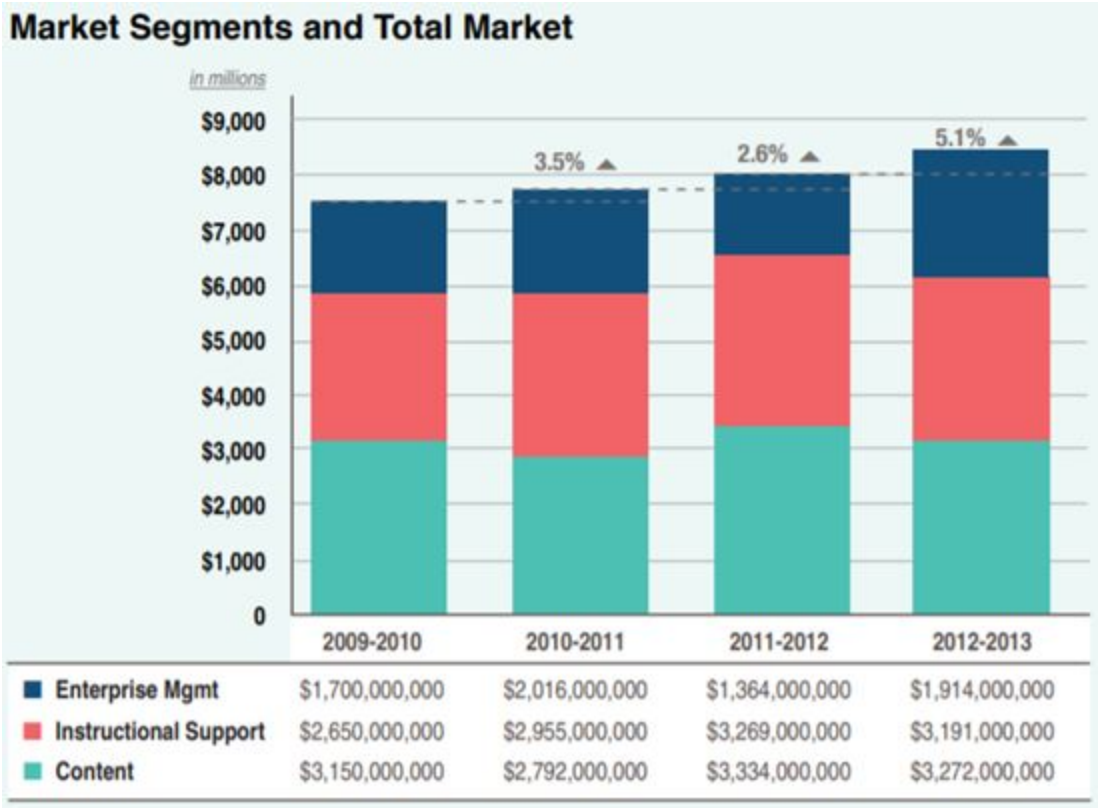


Figure 1. Nationally, preK-12 software and digital resources (Richards & Stebbins, 2014).

This data indicates how public domains, students, teachers and families increasingly started to value the technological approach to the learning process. The emerging areas of technology like machine learning, big data, and artificial intelligence will likely compound to generate an even stronger influence on the education market, yet it will also create issues in choosing appropriate and long-lasting Edtech solutions for schools (Escueta et al., 2017)..

All these technological solutions offer a tremendous potential of giving students access to the better-quality education, a stronger facilitating community of teachers, students, and families(Escueta et al., 2017). However, it is crucial to choose carefully from the wide variety of educational tools and context to meet the actual needs and requirements of the school(Escueta et

al., 2017).. It represents the statement of the problem for the Leicester Research Capstone Project. As it was mentioned above Leicester Public Schools in their vision and strategy wants to serve as the most excellent community asset while bringing student-centered learning in a rich-technology environment. To fulfill this mission in their recent project of building a new school environment, it is important to choose technology solutions adapted to the school goals.

Purpose of the Capstone Project

The purpose of this project is to give Leicester Public School District recommendations for the classroom technology for their new school. LPS Research Team came to these recommendations through the research and analysis the educational technology used in several public schools in Massachusetts that are relevant or comparable to Leicester Public Schools. The educational technology should be cost effective, efficient, scalable, and be robust enough to last for five years. The technology should improve:

- Educational experience of students
- Teaching experience of the teachers
- Student record retrieval for parents/guardian

It should allow students to do their school work from a remote location. In the process we have interviewed the chosen school representatives regarding the use of educational technology in their schools, and the LPS Research Team has recorded the school's responses as well as feedback. This makes up our primary data. As for the secondary data we have done some market research on the current educational technological products. Both primary and secondary data were used to draw conclusions, though we considered feedback from school interviews as the most critical information in reaching a recommendations consensus.

The main purpose is to recommend the best technological solution from the list of alternatives that supports the Leicester Public Schools' mission and vision.

Significance of the Capstone Project

For Students:

This capstone project has provided students with an opportunity to solve real world problems. It will equip students with skills, efforts, and knowledge required in the real world. It allows students to learn:

- How to communicate with team members as well as other stakeholders
- How to approach a real world problem
- How to collaborate in team
- How to follow through with responsibilities
- How to adhere to deadlines
- How to network with various people in the field of study
- How to conduct interviews
- How to conduct research
- How to gather and analyze data
- How to recommend the most appropriate solution

For the Client:

This capstone project is beneficial to the client (Leicester Public School) because the final product of this project is the final report that contains the following information:

- Detailed explanation of educational technology used in other, comparable schools to Leicester Public Schools
- The pros and cons of using specific technology

- The effectiveness of each of the technology used
- The feedback and reviews of the schools that use such technology
- The recommended solution encompassing all the necessary technologies that will enhance the educational experience for students in and beyond the classroom.
- Cost information of some of the technology
- Information about vendor relationships with clients, and the responsiveness of their support team

The solution is realistic and thorough because it involved both primary data as well as secondary data.

The next chapter is about the trends in the industry. It thoroughly explains the uses of latest educational technology and how it improves quality of learning for students, as well as how it makes teachers' jobs easier and more interesting. The trends are subdivided into the following categories:

- Facilitation of free and and public educational resources, such as Khan Academy, and XtraMath. These educational sites are aimed at improving learning experience of students and they consists of a wealth of information that is highly valuable for K-12 students ("Use of Technology," n.d.).
- Accommodating game based learning in the school curriculum. Games have been known to improve critical thinking, and problem solving skills of students, and there are many games that are aimed at enhancing students' knowledge about various subjects such as history, mathematics, geography and so on (Metz & McCune, 2018).

- Parent expectations for school-to-home communications: parents have high expectations on how to receive information from school, classroom and district levels (“Trends in community engagement,” 2017; Warner, 2018).
- Incorporating social media in teaching: social media is become a vital part our everyday life and it plays a huge role in engaging and recruiting teachers. Social media also establishes the school’s brand reputation online and improves transparency (“How to benefit from social,” 2016).
- The use of devices such as laptops and chromebooks is increasing and this is where the future of education is heading (“Mobile learning snapshot,” 2017).
- Facilitating virtual learning, so students can stay connected to their school resources beyond classrooms (Nancy, 2002).

Trends in the Industry

The K-12 education sector has witnessed notable changes during recent years. The digital transformation and the rise of new technologies are drastically transforming the traditional methods for teaching and learning. Technology has permeated classrooms with digital learning tools, such as computers and handheld devices, online and personalized course offerings, learning materials available and supported 24/7, and stronger connections between educators, students and parents. Technologies are accelerating the pace of learning, reducing costs, and making better use of teachers' time.

Historically, education has moved at a slower pace than the business world in adopting new technologies and using them to change traditional methods and practices, but this slow pace of tech adoption in education is changing fast; teachers are changing how they instruct, classrooms are not just chairs and backboards anymore, and students have more access to knowledge through many different channels and formats. In the following paragraphs are described some of the trends that are impacting the education industry today, including virtual learning, open educational resources, game-based learning, new expectations for school to home communications, social media in schools, device in classrooms and data privacy.

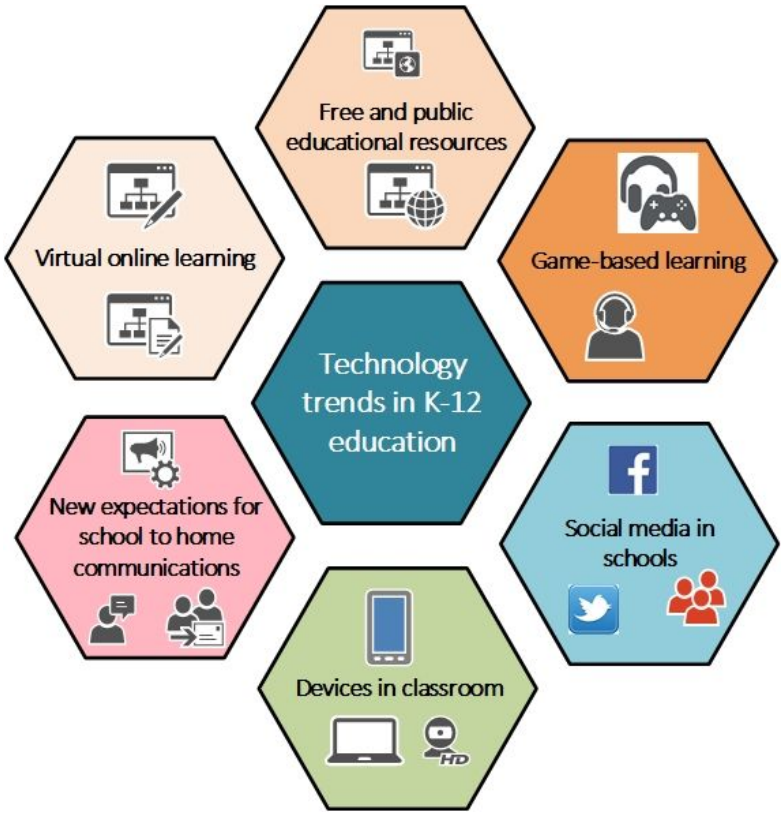


Figure 2. Technology trends in K-12 education

Virtual online learning (full-time and blended)

An online school teaches students partially or fully through the Internet. Learning materials, exercises, self-paced courses, live or real-time classes, tests, web forums, and others benefits are primarily provided through the Internet. Physical interaction between teachers and students is not needed or only supplementary. According the U.S. Department of Education 48 states and the District of Columbia currently support online learning opportunities ranging from supplementing classroom instruction to full-time programs ("Use of Technology," n.d.). Dual enrollment, credit recovery, advanced placement and honors courses, remediation classes,

summer programs, and electives are examples of the opportunities offered by these programs ("Use of Technology," n.d.).

In a full-time online school the students are not attending a brick-and-mortar school at all; instead they receive all of their instruction and earn credits exclusively through the online channel ("Use of Technology," n.d.).

Blended learning combines online digital media with traditional brick-and-mortar classroom methods and requires physical presence of both teacher and student. This strategy is often utilized to accommodate diverse learning styles among students and to enable them to work before or after school in ways that are not possible with full-time conventional classroom instruction. This method can be especially useful in rural or remote areas where either blended or fully remote learning can help teachers and students to prevail over the distance ("Use of Technology," n.d.).

The following list includes examples of full-time online schools and blended learning programs across The United States ("Use of Technology," n.d.).

The Florida Virtual School (Florida): it is a complete online school operated by the State of Florida to provide learning opportunities to full time students from grade K to 12 ("Use of Technology," n.d.).

Karval Online Education (Colorado): this is an online public school which provides learning opportunities for Colorado residents and it also provides a free computer and reimbursement for educational expenses such as internet and related costs ("Use of Technology," n.d.).

Campbell County Virtual School (Wyoming): this online school not only provides learning opportunities to the students from grade K to 6 in the state of Wyoming, but also lends computers and grants subsidy for internet connectivity as well other important materials that facilitates an a collaborative online learning ("Use of Technology," n.d.).

North Carolina Virtual Public School (North Carolina): this online school offers courses that helps student prepare for the colleges and universities, the courses include world languages, credit recovery, advanced placements and honor courses. The school provides services such as test preparation and career planning to students to help them choose the right path ("Use of Technology," n.d.).

Utah Electronic High School (Utah): this online school has been in existence for over 18 years offering variety of online course and diplomas to students who have dropped out of schools, students who are home-schooled, or students who are unable to graduate from normal high schools ("Use of Technology," n.d.).

Guided Online Academic Learning Academy (Colorado): this is an online school which offers over 200 courses to students in Colorado between the ages 14-21("Use of Technology," n.d.).

Michigan Virtual School (Michigan): this online State operated school provides full-time learning opportunities to middle and high school students of Michigan, it also grants course credits as well as diplomas("Use of Technology," n.d.).

Riverside Virtual School (California): this online school provides interactive courses to students between grades 6 and 12 in the Southern California ("Use of Technology," n.d.).

Carpe Diem Collegiate High School (Arizona): this school provides the hybrid of online and onsite training to the students on Arizona ("Use of Technology," n.d.).

Free and public educational resources

The schools are incorporating open educational resources (which are freely available to public domain) to improve their curriculum. Education has been revolutionized by various types of media such as virtual libraries, videos, e-books, podcasts, and games; all extensively available online and most of it is free. Below are some of the sites that offer open educational resources for schools ranging from K-12 grades.

ck-12.org: they offer standards-aligned and customized digital textbooks called Flexbooks which facilitates high-quality learning by providing adaptive learning environment("Use of Technology," n.d.).

Khan Academy: it is a non-profit organization that facilitates extensive learning by providing online assessments, video library, and practice exercises, which is intended for K-12 school students to learn math, history, physics, finance, and physics ("Use of Technology," n.d.).

XtraMath: this is a web program intended to teach math concepts such as addition, subtraction, division, and multiplication to students, teachers as well as parents, and it also generates progress reports to measure your skills ("Use of Technology," n.d.).

The U.S Department of Education has urged that these open educational resources adhere to the standards of quality, accuracy, and integrity set by the government and they facilitate the learning growth of disabled students ("Use of Technology," n.d.).

Game-based learning

Games are gaining popularity in education, as students can be motivated with well-designed games. These games have incorporated emerging technologies such as virtual reality, augmented reality, 3D printing, and modern learning approaches like puzzle games and narrative adventures (Metz & McCune, 2018). Well-designed games can actively engage students, stimulating their critical thinking, problem solving, and employment and life skills. Several U.S. government institutions are actively funding the development of learning games (Metz & McCune, 2018).

Typing practice, reading, listening, math, grammar, history, literature, arts, music, sciences, geography, animals, nature, human body, technology, health, and brain games are some of the disciplines where gaming based learning has presence in K-12 education (Metz & McCune, 2018).

New expectations for school to home communications

As new technologies and communications platforms emerge and penetrate their personal lives, parents increasingly prefer using similar tools to be informed about what happens with their children at school and in classroom. According the *Project Tomorrow's annual Speak Up 2017 Research Project*, parent expectations for classroom, school, and district communications and engagements is higher each year ("Trends in community engagement," 2017).

The report shows that parents want the information to be pushed to them instead of having to search for it. At the same time parents don't want to receive avalanches of messages,

or to be woken up in the middle of the night; they prefer timely, personalized, and highly impact information. Email and text messages are the best way to reach parents, regardless of whom the communication is coming from (teachers, school administrators, or the district) ("Trends in community engagement," 2017). The number of parents who prefer visual social media channels (e.g. Youtube, Instagram, Facebook, and Twitter) is increasing. Schools are re-calibrating their communications strategy to support the emerging digital solutions and the different needs of parents (Warner, 2018).

Social media in schools

Another notable trend in K-12 education is the use of social media tools. Social media constitutes a powerful instrument to bring to light new learning resources and ideas. Applications like Twitter enable communities of educators to stay connected. Schools are using social media to recruit new teachers, and many educators today are relying on social networks to create their personal learning networks and to drive their professional development activities ("How to benefit from social," 2016).

By incorporating social media into teaching techniques educators are able to increase student engagement, contributing to a greater sense of collaboration in the classroom and building better communication skills ("How to benefit from social," 2016).

Devices in classroom

Incorporating mobile devices into the classroom is key for properly and effectively preparing students for the future. Mobile computing devices are able to connect students and

educators to the vast resources of the Internet and facilitate communication and collaboration ("Mobile learning snapshot," 2017).

Recent years have shown a tremendous increase in the classroom set of computing devices. iPads, laptops and Google Chromebooks are widely used in classrooms all over the country. A survey conducted by *Freckle Education (formerly Front Row Education)* in 2017 shows that over 50 percent of teachers say they now have a 1:1 student-to-device ratio, up nearly 10 percentage points over the previous year ("Mobile learning snapshot," 2017).

The *Mobile Learning Snapshot 2017* reports how mobile devices are used for learning at schools, both for teacher-sponsored activities and for student self-initiated activities such as: taking online tests and quizzes, watching videos, sharing documents, working with other students, playing educational games, checking grades, looking up information for class, taking notes, receiving reminders about due dates and upcoming tests, texting classmates for help, and emailing teachers with questions ("Mobile learning snapshot," 2017).

Data Security and Privacy

As technology is increasingly used for school administration and record-keeping and in the classroom, schools should ensure strong authentication and confidentiality systems are in place. Students should be required to regularly update their school account password, and increase the complexity of passwords to protect their safety and privacy. School data should be managed hierarchically (Nancy, 2002). For example, confidential data should be safeguarded according to appropriate regulations and industry standards and is prohibited from being disseminated inappropriately. Schools and those responsible for their information security

should ensure proper data management practices, policies, and tools are in place to prevent hacking and information leakage(Nancy, 2002). With the increasing integration of internet-based and traditional teaching methods, schools should pay attention to Cloud Data Storage and Cloud Computing Security. Schools should make adequate preparations for the potential moral and security problems that using technology may bring to schools (Nancy, 2002).

The next chapter covers the design method and procedures followed by the LPS Research Team to conduct our research and achieve the final results. It also explains ethical issues and concerns that could impact the data and stakeholders involved.

Methods

Design

Before arriving at a final design plan for this research project, the LPS Research Team gathered background information on the town of Leicester and the Leicester Public Schools district, using the district's own website, and that of the town, as well as Massachusetts census data (see Appendix B for further information) (U.S. Census Bureau, 2010). The team then met with the client to discuss the client's needs, as well the background information on the project, and the nature and extent of research that would prove most beneficial in advising the technology plan of Leicester Public Schools' proposed new building. During our initial meeting, the client expressed that it would be especially helpful to have information directly from schools or districts that had already undergone similar technology projects.

After the initial interview, we used the research we had already conducted on industry trends, and the details of the desired outcome from our client to design the materials that we would use to steer the rest of our project, in order to provide the best outcome for the client. As a result of this work, our team has created a framework for conducting research of this nature into educational technology implementations, which can be used for future research progress in this same space. This framework consists of three main components, which will each be included in Appendix D (Framework). These components include a three-part technology inventory template, a standard question set, and a Google Form to compile data from interviews.

The technology inventory template was designed in accordance with our analysis of industry trends in educational technology, as well as in alignment with the type of information

the client wanted us to uncover. The standard question set was designed to fill in any gaps that would not be answered by the technology inventory template, in order to give a complete and multi-faceted picture of the technology plan used in each school and district.

Initially, our framework consisted only of these first two items, and our interviews were conducted using these tools alone. The Google Form was an additional tool that we designed and implemented after our initial interview phase. After designing our initial framework, this research project included two main phases of research, and an analysis and conclusions phase.

The initial research phase was conducted using internet resources to identify schools and school districts that would be beneficial to speak with, and then to gather more information about those districts and their technology projects. The LPS Research Team identified schools and districts to speak with based on several criteria, including the scope and nature of the technology projects they completed, the size and demographics of the district that the technology plan serves, and how recently the technology project was completed. Our team's goal was to gather information via interviews with district or school representatives from 5-8 schools across a variety of these factors who had completed their own technology projects as recently as possible but within the past 5 years, and to compile the data in a meaningful way that will benefit the Leicester Public Schools' research into their own upcoming project.

During the second research phase, the team interviewed representatives from the chosen schools and districts who were willing to speak with us regarding their technology plans. The LPS Research Team contacted Douglas Public Schools' Douglas Elementary School, Worcester Public Schools' Nelson Place Elementary School, Auburn Public Schools' Auburn Middle School, Webster Public Schools' Park Avenue Elementary School, Shrewsbury Public Schools'

Sherwood Middle School, Hudson Public School District, Lowell Public School District, and Franklin Public Schools. The team received response from seven of the eight schools contacted. The responses from the schools were recorded on the technology inventory template, and we asked questions from our standard question set, as well as exploring any other topics or technologies that came up during the interview. These interviews were conducted in a variety of methods, with some being conducted in person, some via e-mail, and some via telephone calls. Our team also was able to tour several classrooms, to see the implemented technology plans in action. In all, we collected data from 7 schools and districts within Massachusetts.

In addition to interviews conducted during the second research phase, our team also continued to use internet resources to research vendors and products in the educational technology space, as well as emerging trends.

After completing our research, the team conducted an analysis and conclusions phase. During this phase, we identified the need to consolidate the large quantity of information we obtained from our interviews, and in response we created a Google Form based on the questions and templates used in our interviews. Each team member input the information that they gathered during their research into the form, allowing us to combine the research into a single document that allows us to cross-reference the materials from our individual interviews, and also allows us to quickly identify and analyze trends with the help of graphs created by the responses to the survey.

The Google Form was divided into distinct sections based on logical division of the type of information requested in each section. Not all sections or questions were presented to all team members, as the Form was designed to be responsive to certain qualifying questions. For

example, the form asks “Do any students use a desktop computer as their primary device in the classroom?”; if the answer to this question is “No,” then the Form skipped any other questions pertaining to desktop computers, and continued to the following section. Questions that were included in the technology Inventory Template were mandatory, but questions from the standard question set could be skipped if information was not available. This was to allow for situations where the school or district was either unwilling or unable to provide detailed information in certain subjects.

The most exciting implication of the Google Form and response sheet that we created is that it fulfills a need for a standard template to be able to perform similar research in the future, for LPS or for other schools or districts. Since the pace of technology adaptation in education is constantly evolving, this is a real and critical future need. Our team created this Google Form not only for the analysis specific to this project, but also because we recognize that any research involving technology has an expiration date built in, and the research will need to be updated often.

Ethical concerns

The ethical concerns for the LPS Research Team for this project relate mainly to collecting and safeguarding data obtained in interviews, and in compiling and relating this information in an accurate manner.

An important part of the project is the collection of data from seven schools. This data is a mix of publically available data from the internet, and primary research gathered from interviewing representatives from several schools and districts. LPS Research Team began the

interview process by reaching out to appropriate contacts within the schools and districts to ask for approval to conduct the interviews, and our initial communication explained the reason for our research. We designed the framework in consideration of the need to ensure that data collected was truly needed and will be implemented in the project. When we used this data for analysis and management, we ensured that data was transcribed accurately by having each team member report on their own interview individually.

An additional ethical concern for the LPS Research Team was representing the data accurately, but in an aggregated and anonymized way, so that specific responses would not be directly tied back to a particular individual. Graphs used in this paper only show statistical numbers, not individual school data, and when tables are presented in this paper showing individual responses, the order of these answers is changed from table to table. This precaution was taken to ensure that any feedback expressed in addition to the factual information requested was kept private.

A related ethical concern that should be considered for future projects relates to the collection of data from the Google Form that was implemented during the analysis phase. LPS Research Team used this form for the purpose of compiling and analyzing our own notes taken during research interviews, and it was not shared or sent publicly, however if the form is adapted for future research projects to be sent as an anonymous survey directly to school contacts, the survey form would need to be reviewed by the Clark Committee for the Rights of Human Participants in Research and Training Programs.

Data Analysis

Our data set for this project was comprised of a small sample size, where each collection of data in the set was complex and detailed. For this reason, we performed our data analysis by compiling our seven data sets from each individual school or district into one uniform format for comparison. We achieved this by formatting an output file for the Google Form that our interview data was entered into. The final results included graphs for certain short-answer and multiple choice questions, showing the distribution of the technologies encountered. For more complex information, the output file from the Google Form lined up the seven answers in easy to read columns, and in a meeting, our team viewed and discussed these answers.

In addition to the answers provided in the Google Form that allowed us to view at-a-glance how the schools' implementations were similar and where they differed, our team discussed the feedback received from representatives of the schools and districts regarding the implementation of their classroom technology. In some instances, schools employed two competing technologies, and voiced a clear preference for one over the other, and in those circumstances our team took their preferences and feedback into account when determining where we could draw a clear consensus for a final recommendation.

During our analysis phase, LPS Research Team identified several key patterns of information and feedback among the schools and districts we surveyed, and we are presenting these patterns in the Results and Reflections section, which immediately follows.

Results and Reflection

Findings

Overview

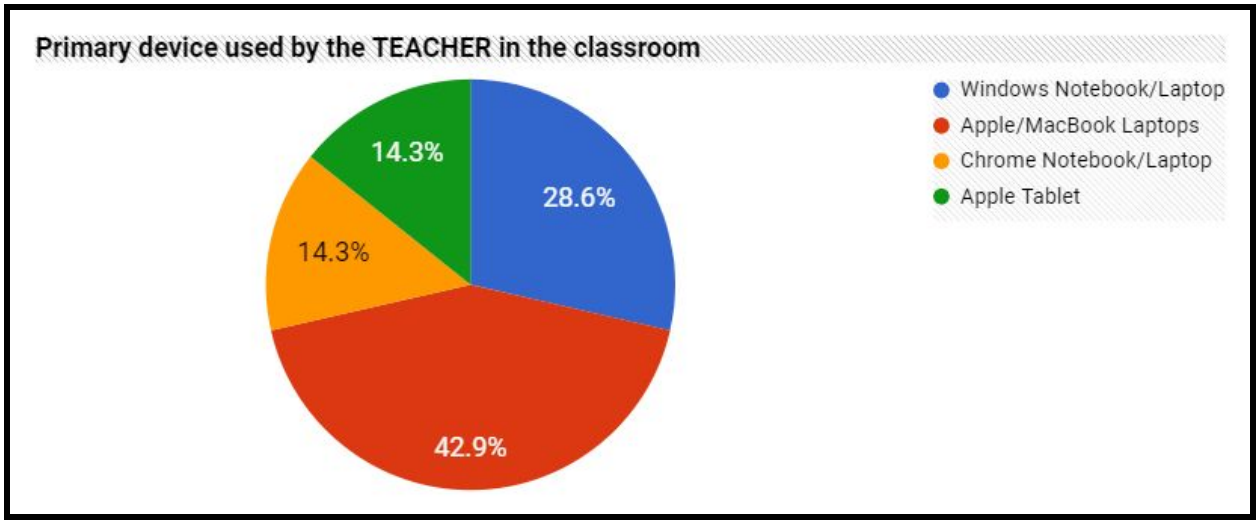
The LPS Research Team reached out to ten school districts and was able to interview seven districts. See Table 1A for further information about school or district size. These districts were picked based on their projects and upgrades in technology in the recent past. The school and district representatives interviewed for this project were five IT Directors or Managers, one School Principal or Administrator, and one other IT professional. Some of these interviews only encompassed a single school while others were an entire district. These included elementary, middle and high schools. 57.1% of these school have upgraded their technology within the last year and half, and the rest have upgraded within the last 3 years.

Number of Students in School or District Surveyed	
400	Douglas Public Schools' Douglas Elementary School
494	Worcester Public Schools' Nelson Place Elementary School
592	Auburn Public Schools' Auburn Middle School
800	Webster Public Schools' Park Avenue Elementary School
967	Shrewsbury Public Schools' Sherwood Middle School
2650	Hudson Public School District
14075	Lowell Public School District

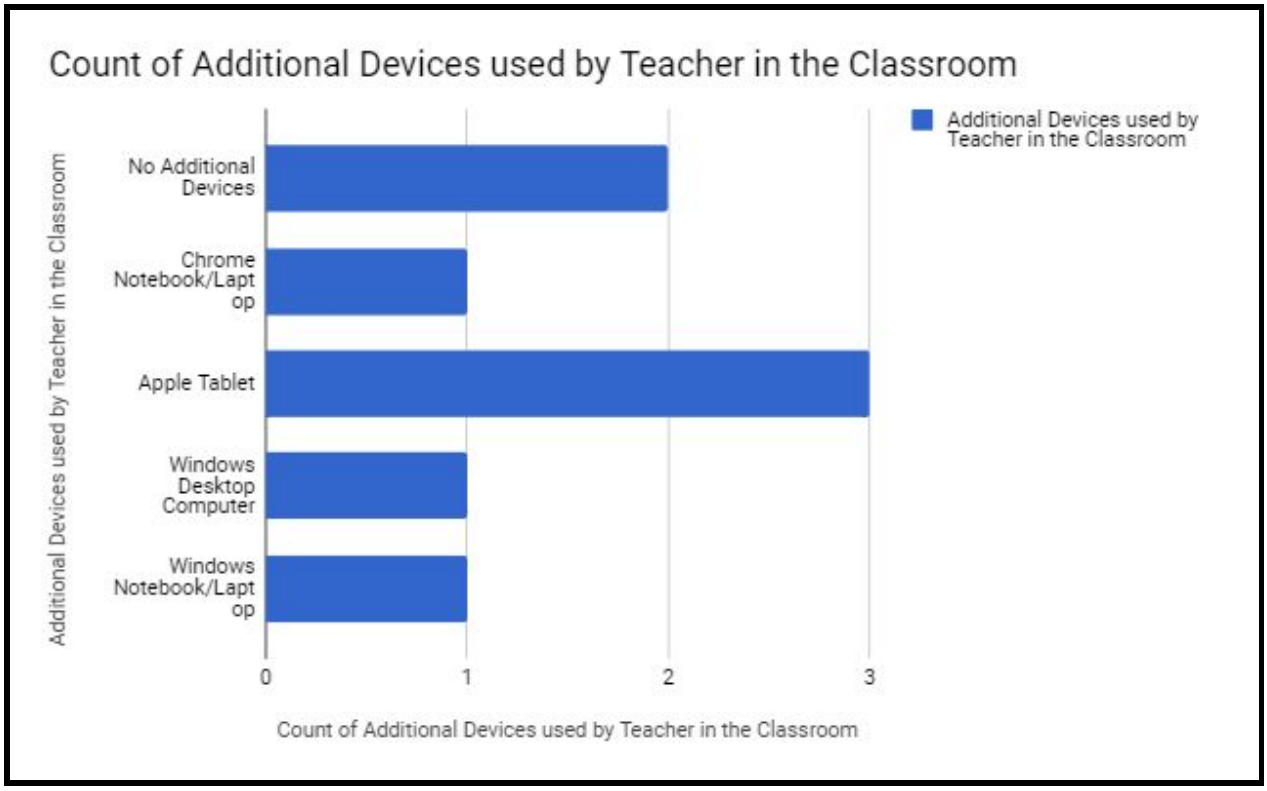
Table 1A

Education Hardware for Teachers

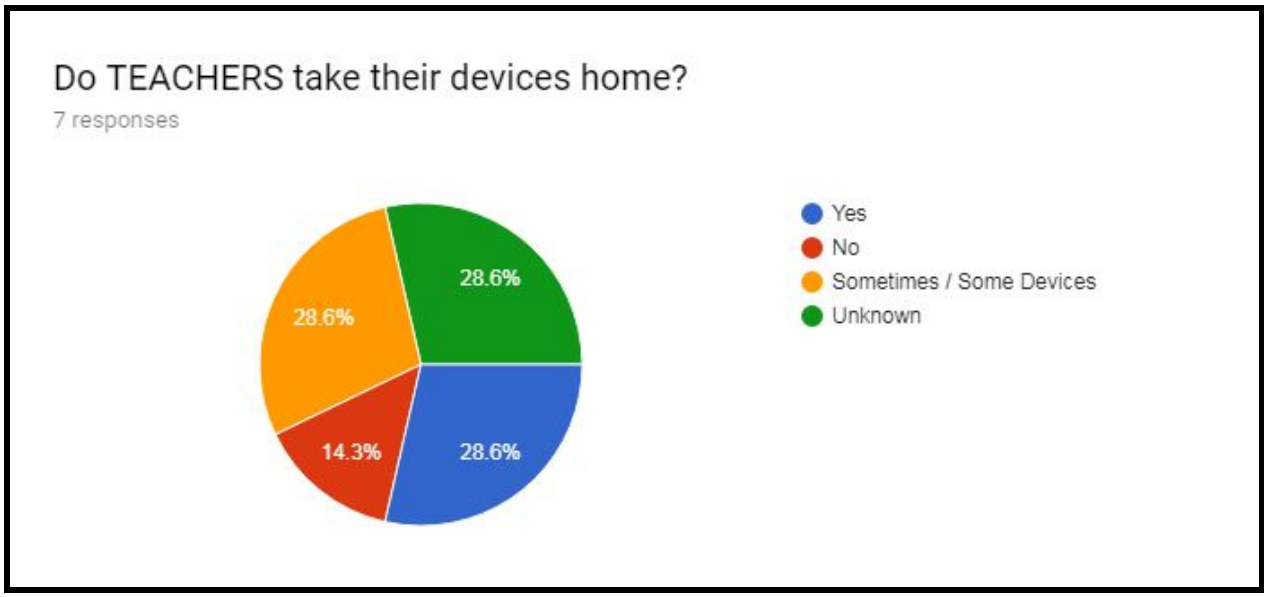
The LPS Research Team's research found that the majority of teachers, 42.9%, use Apple or Macbook as their primary device in the classroom (see Graph 1A). This was followed by teachers using Windows Notebook/Laptop at 28.6%, Chrome Notebook/Laptop at 14.3%, and Apple Tablets at 14.3% (see Graph 1A). Although the LPS Research Team found that Apple or Macbooks are used most commonly, this does not align with the recommendations based on the comments from the schools on using the same processing system for all devices, see results section for further details. In addition, 42.8% of teachers used an Apple tablet as a supplementary device (see Graph 1B). LPS Research Team also found that of known results, 80% of teachers were able to bring home their devices at least sometimes (see Graph 1C).



Graph 1A



Graph 1B



Graph 1C

Educational Hardware for Students

In 80% of the schools LPS Research Team saw a 1:1 ratio with students and their primary classroom device (see Graph 2C). The LPS Research Team's survey found that 71.4% of students use a laptop or notebook as their primary device in the classroom (see Graph 2A). 60% of schools leased these laptops or notebooks through a leasing contract with an outside company (see Graph 2B).

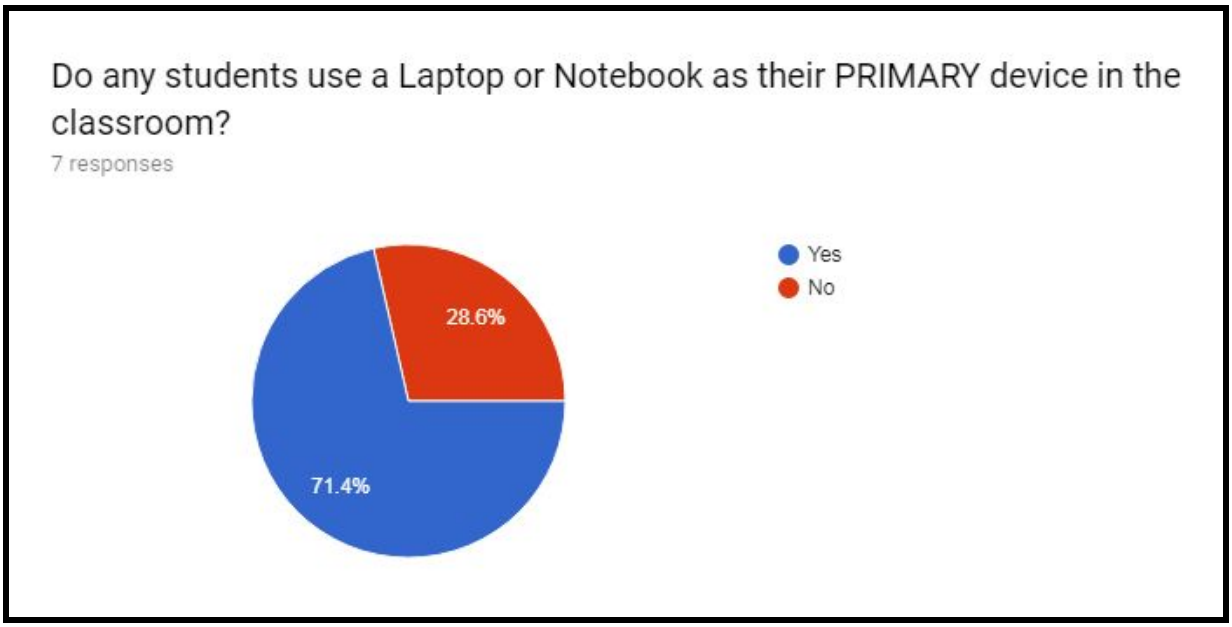
Schools reported using majority Chromebooks, but one school used Apple MacBooks for their students. The only vendors reported for laptop/notebooks were Google and Eplus. The laptop/notebooks were used for grades 2-12 depending on the school (see Table 2A). The survey found that 60% of the schools allowed students to bring the laptop or notebook home with them even if it is conditional by grade level (see Graph 2D). The majority of these laptop/notebooks, 60%, are charged with portable charging carts (see Graph 2E). The majority of these laptop/notebooks are replaced every three years or more often. LPS Research group found that the students often keep the same device during their entire time in either middle school or high school and the device is replaced when a new generation of students enter the school. For example one school reported 2nd, 5th, and 9th graders are given new units each year, the devices then cycle up with them until the next replacement year. This means that schools following a similar model are purchasing or leasing a set of new devices every year for one grade level of students (see Graph 2F).

The LPS Research Team also found that 57.1% of classrooms surveyed used tablets. All of these tablets were bought outright instead of being leased. The majority of classrooms that used tablets had Apple Tablets at 75%, while 25% of the tablets were Android.

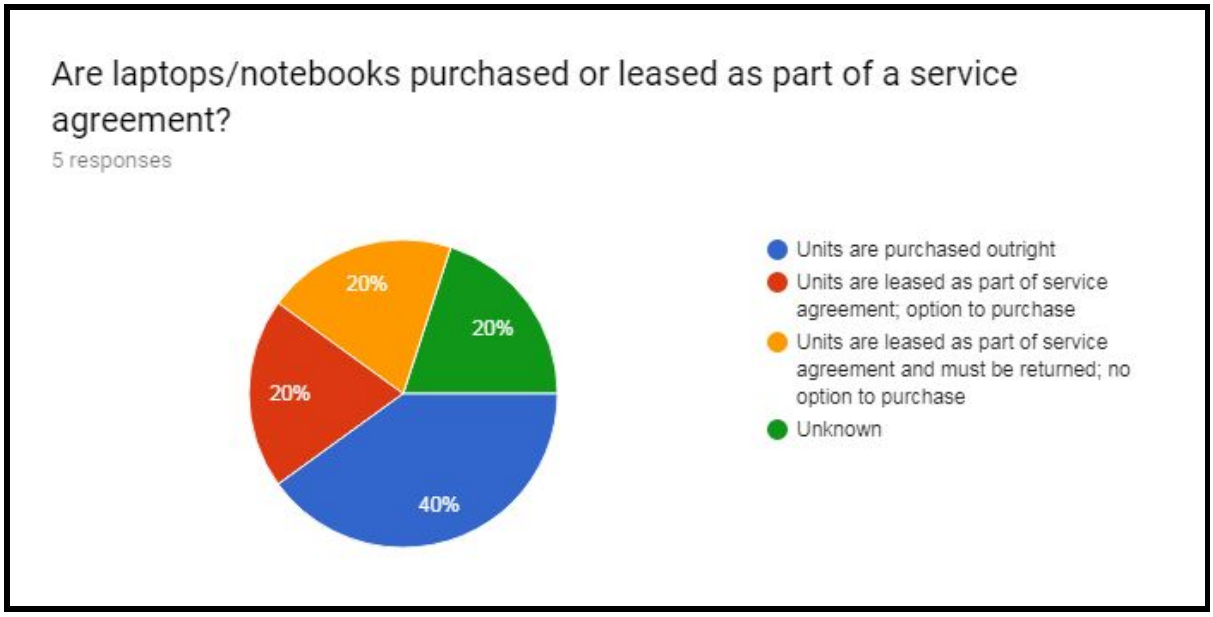
The models schools reported using include Apple iPads, iPads Air / Air 2, and Samsung Galaxy Tab. Half of these tablets have a 7.8-9.9 inch screen (see Graph 2G). The majority of classrooms that used tablets had a 1:1 ratio at 75% (see Graph 2E). Unlike the laptop/notebooks, 50% of the classrooms did not allow students to take the tablets home (see Graph 2F). LPS Research Group found that half of the tablets are charged by portable charging carts and half are charged in stationary sharing stations. The tablets are replaced 33.3% of the time only when they are fault, 33.3% of time at age specific intervals, and finally 33.3% of the tablets were being phased out for chromebooks so they did not have a projected life cycle. Overall, schools saw that the tablets were much more difficult for students and teachers to use than laptops/notebooks. One school reported that they should have put a replacement plan/budget in place. Now their iPads are aging and they do not have the means to replace them. Two schools reported that in hindsight they would now issue only Chromebooks instead of iPads and lease them instead of purchase them, and both of these school districts are now moving toward Chromebooks. Three schools reported only using tablets for lower grades, Pre-kindergarten through 2nd grade. Only one school reported using tablets for older grades, 6-12.

Laptop/Notebook Usage by Grade Level
3-6 in elementary school
5-12
Grade 2 and up
Grade 5-12 Chromebooks that they take home, grade 4 chromebooks that stay in the classroom
grades 3&4 to be 1:2 ; grades 5-12 to be 1:1

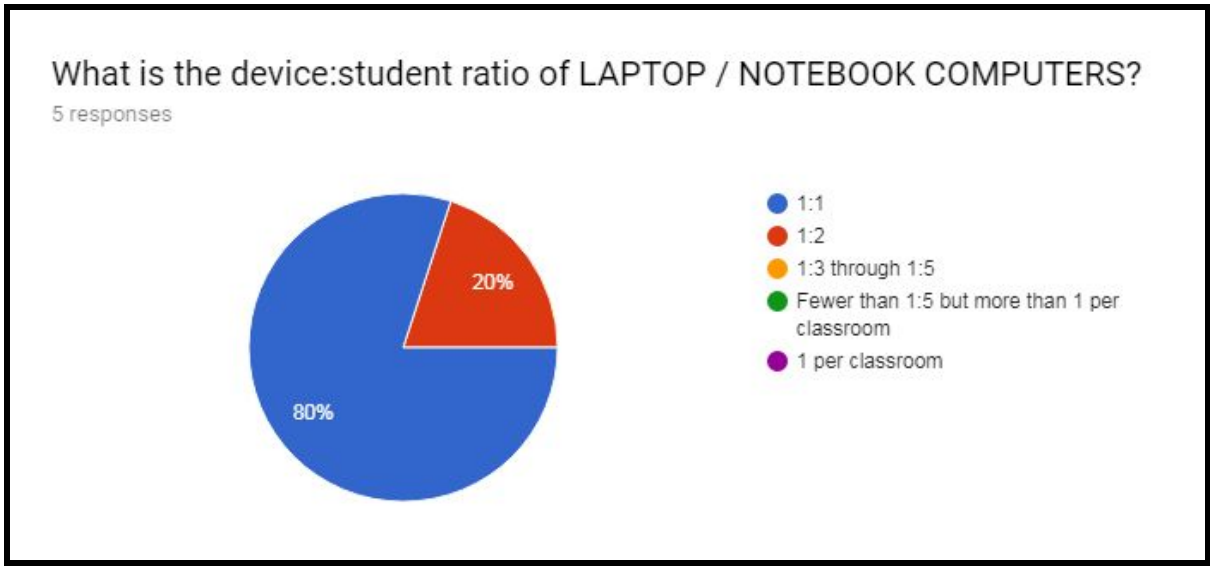
Table 2A



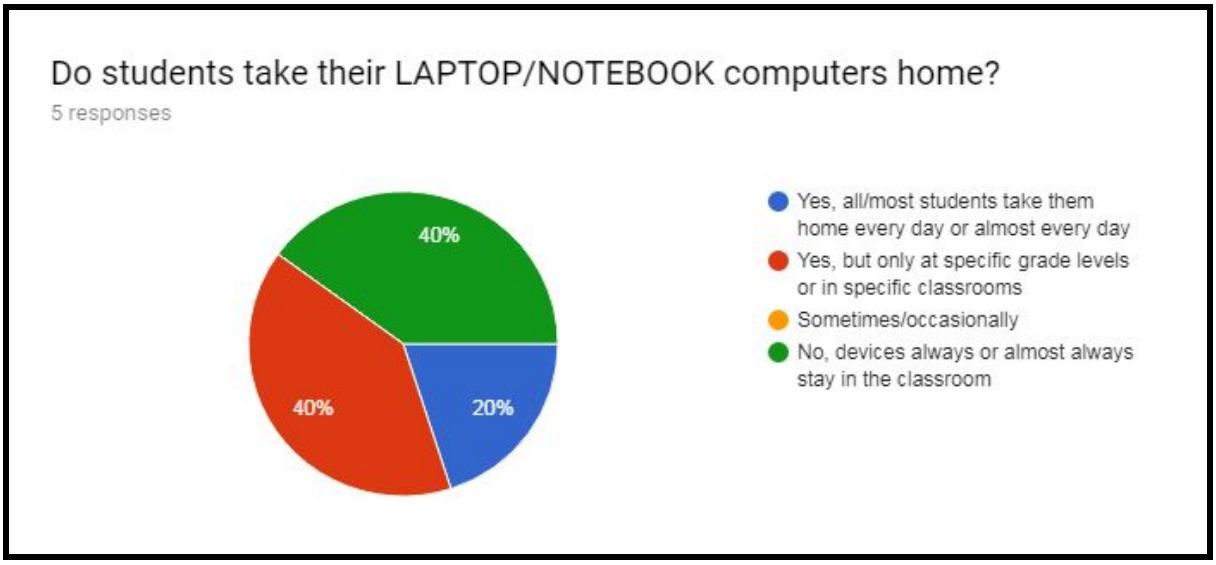
Graph 2A



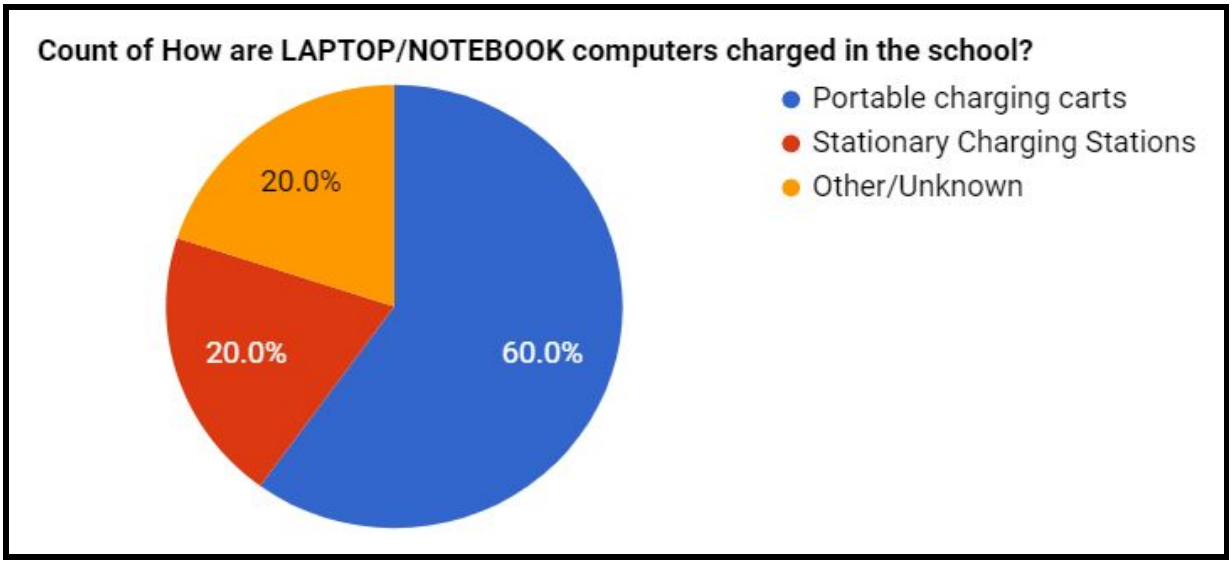
Graph 2B



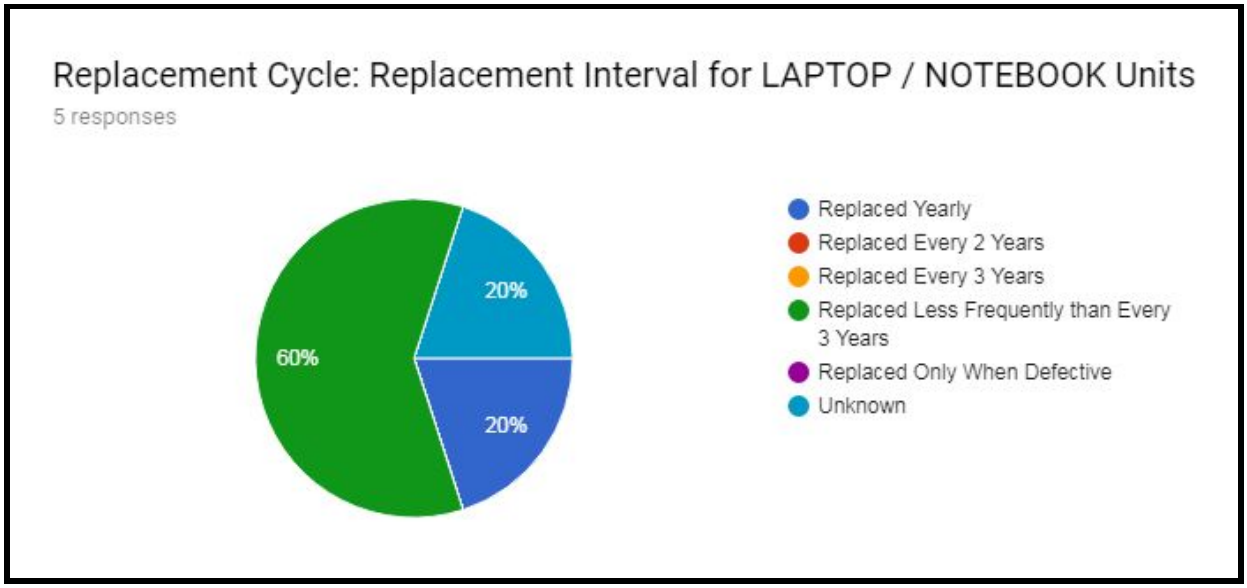
Graph 2C



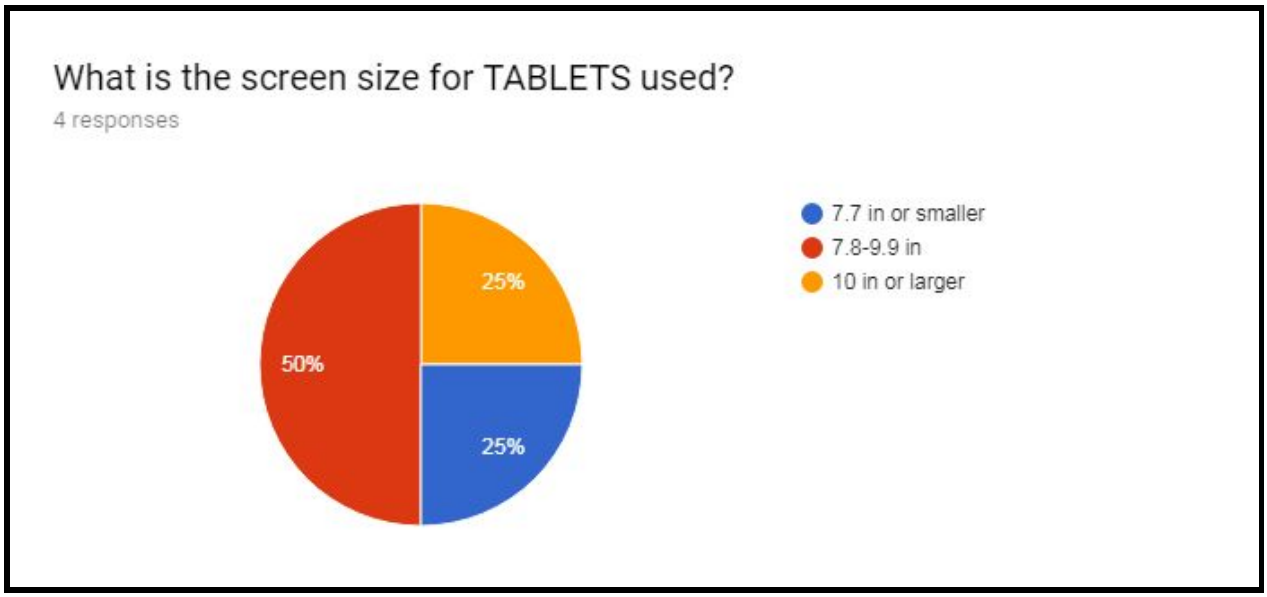
Graph 2D



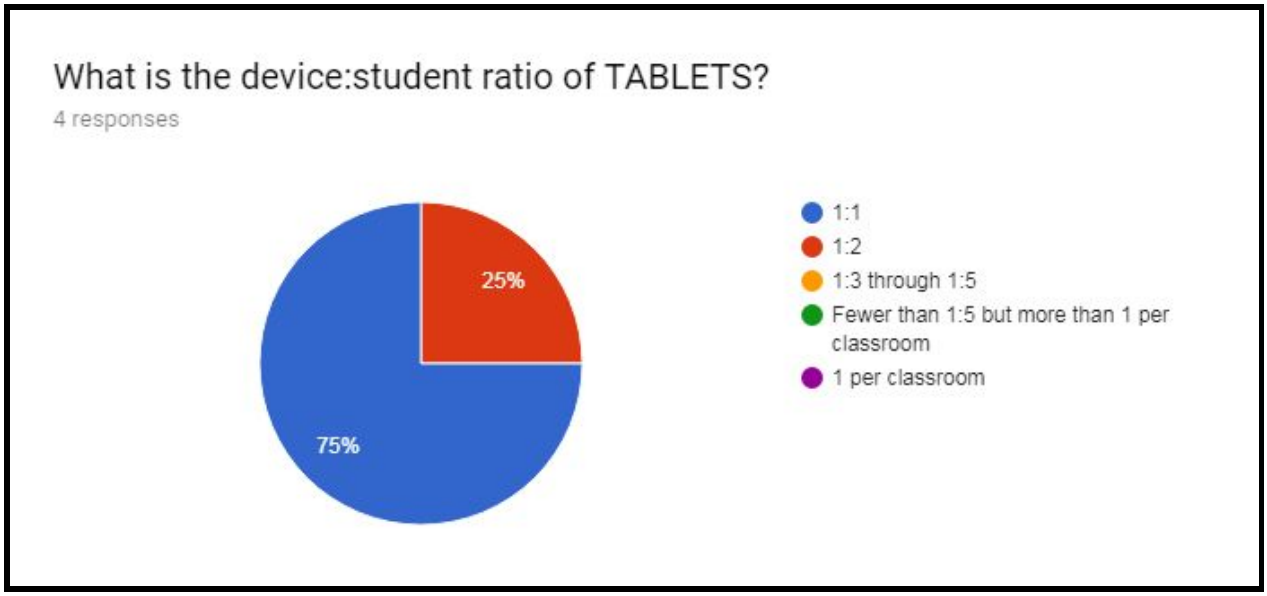
Graph 2E



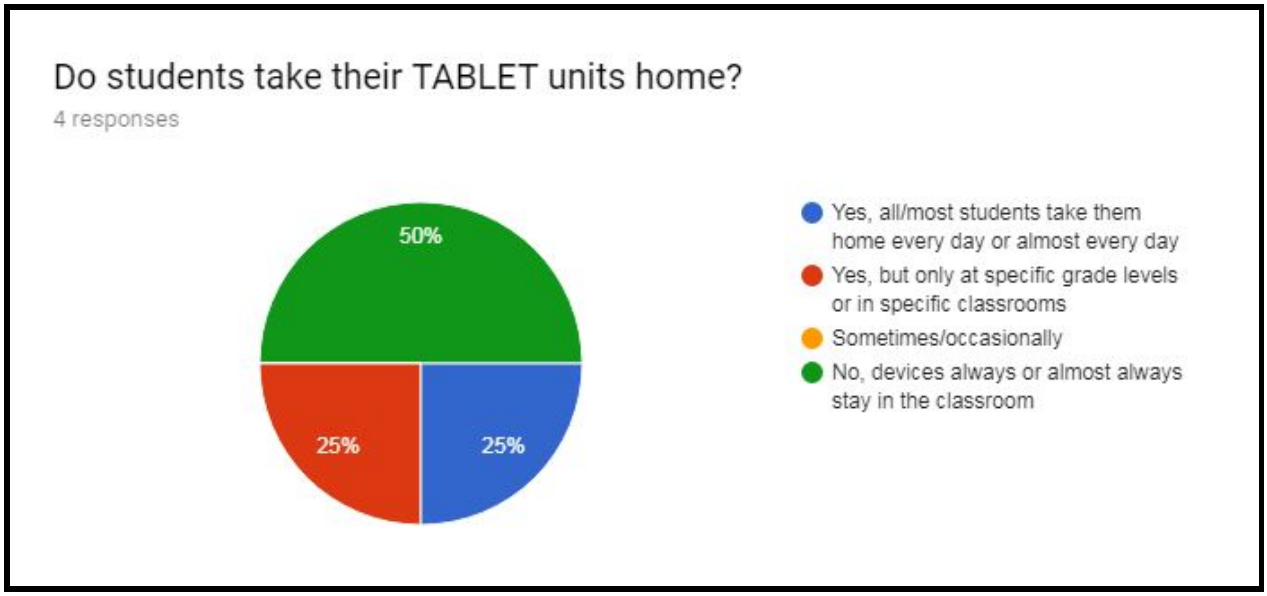
Graph 2F



Graph 2G



Graph 2E

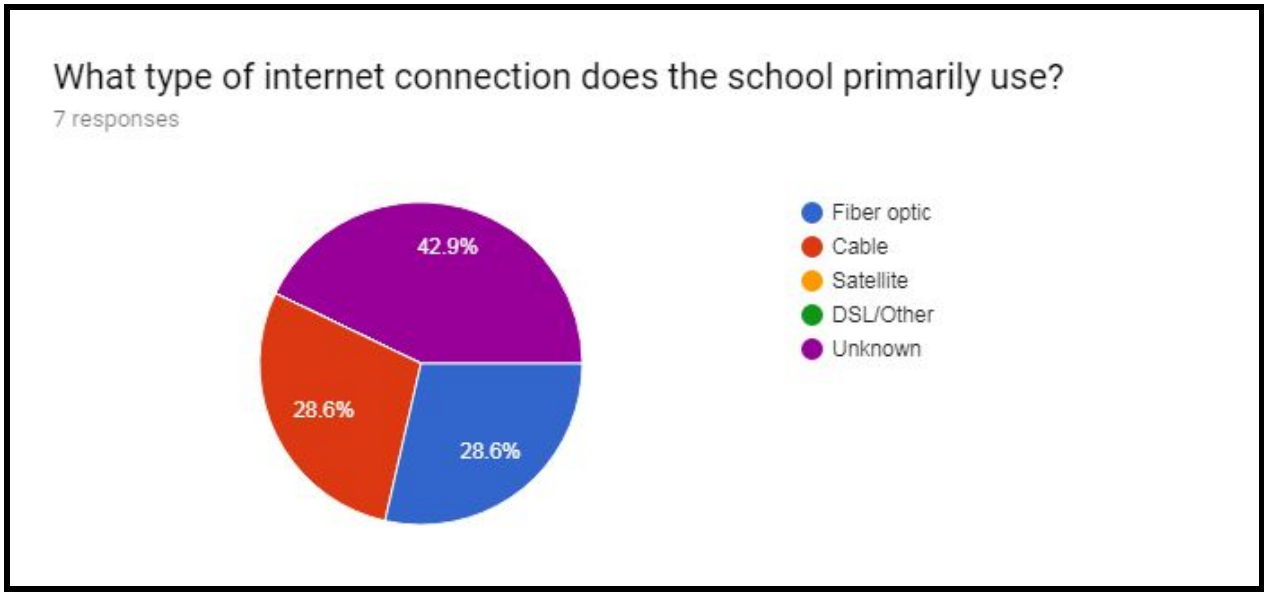


Graph 2F

Internet Connection

LPS Research Team found that all schools that reported availability details for wireless internet access had a wireless access point in almost every classroom. Wired connections were only available in 28.6% of the classrooms. Half that reported back on type of internet connection

the school primarily used as cable, while the other half used a fiber optic connection, however 42.9% of the schools did not report on their internet connection source (see Graph 3A). The schools with fiber internet connections reported speeds between 100Mbps and 5Gbps.

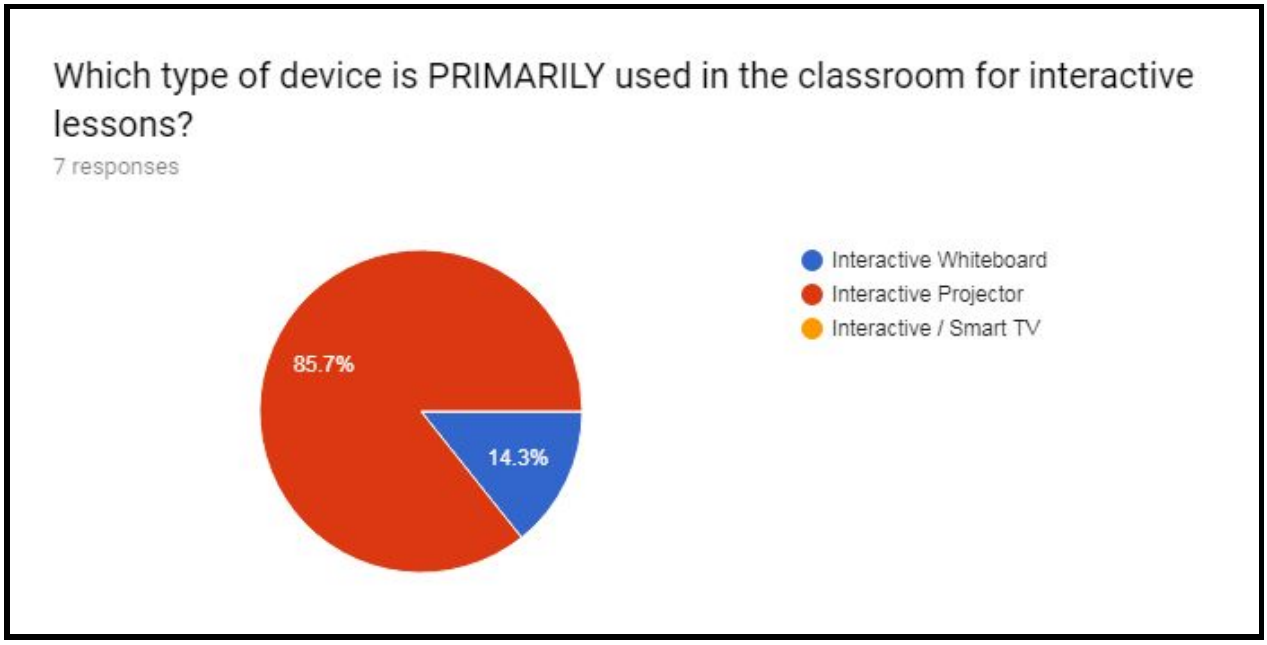


Graph 3A

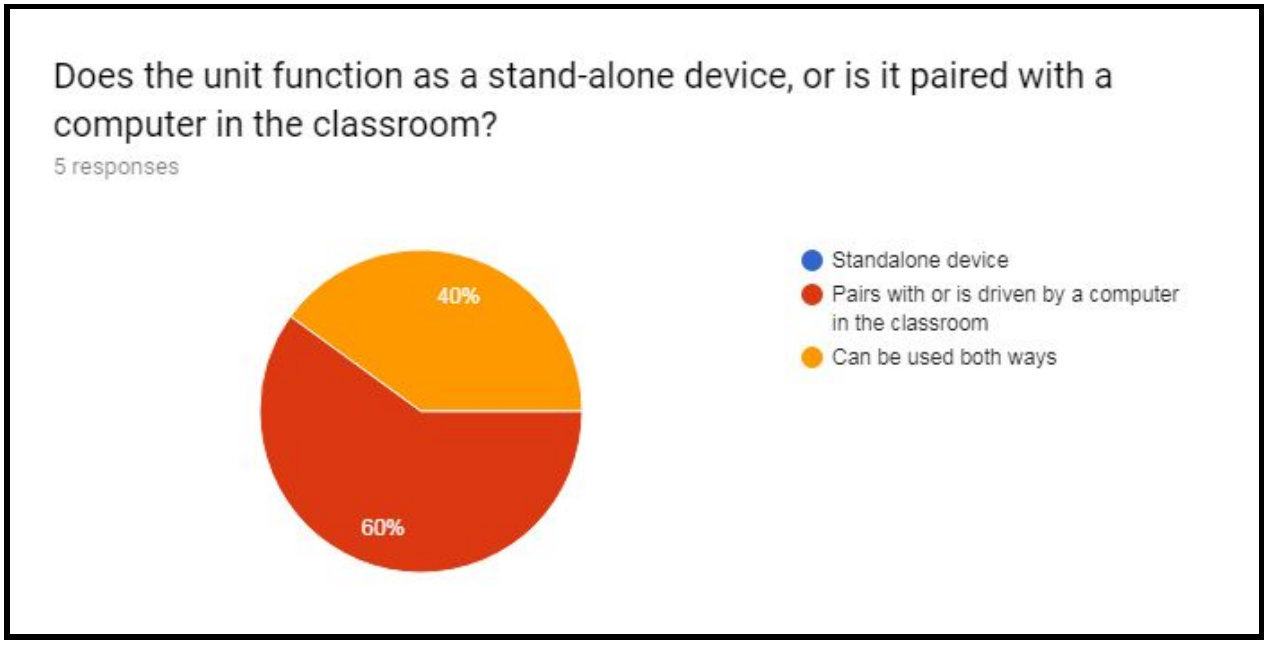
Interactive Classroom Technology Boards/Smart TV

The LPS Research Team's survey found that 100% of schools used interactive whiteboards or interactive projectors in almost every classroom; 85.7% of these classrooms primararly used interactive projectors, while 14.3% of classrooms primarily use interactive whiteboards (see Graph 4A). Schools reported using many different brands of projectors and smart boards including Brightlinks Interactive Projector, Eno Board, Epson Projectors, Promethium boards, and NEC. All of these units can be paired with the teacher's primary device while some schools also have interactive whiteboards or interactive projectors that also could be

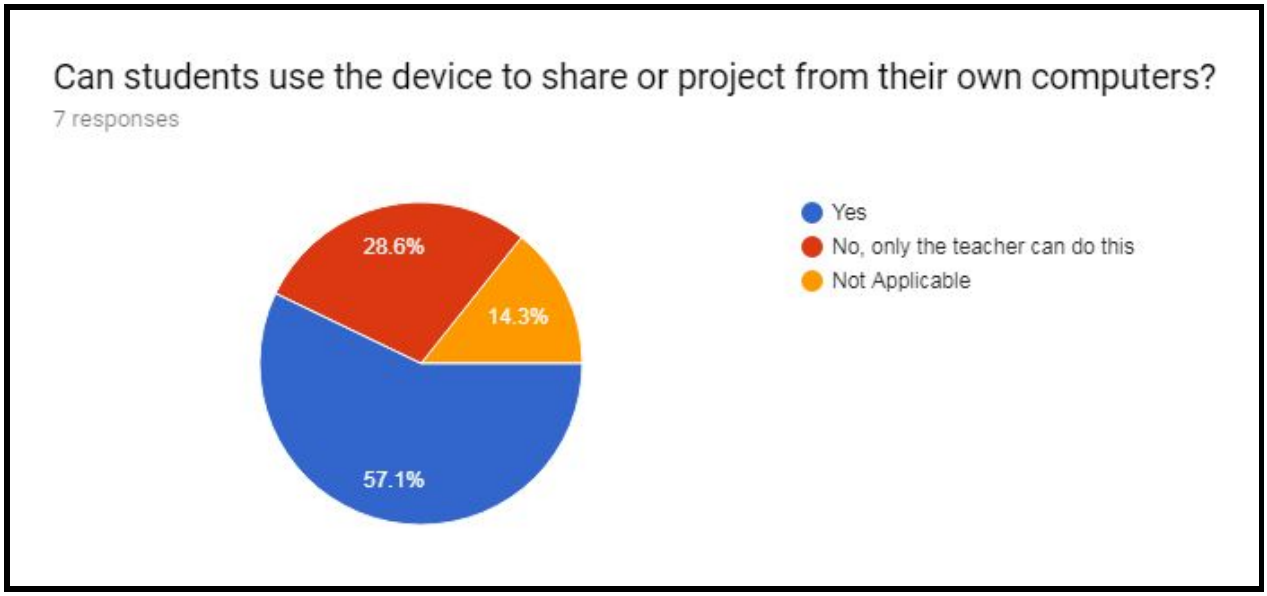
used as a standalone device (see Graph 4B). 57.1% of students can use their devices to project or share on the whiteboards or interactive projectors (see Graph 4C). One school reported that they would not buy smart boards again, they found that they would rather have an interactive projector.



Graph 4A



Graph 4B

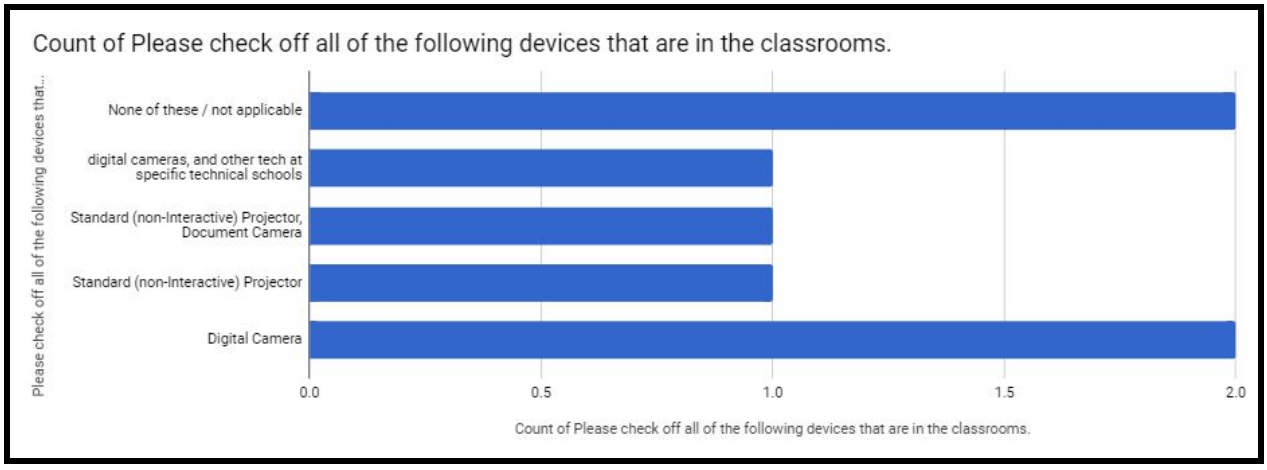


Graph 4C

General Classroom Technology

The LPS Research Team found that in schools with printers that they either had them by floor, department or one per classroom depending on the school. Not enough schools reported

their amount or use of 3-D printers, standard (2-D) scanners, 3-D scanners in the classroom to report results. The following devices are found in classrooms in the schools digital cameras, and other tech at specific technical schools, standard (non-interactive) projector, document camera, and digital cameras (see Graph 5A).



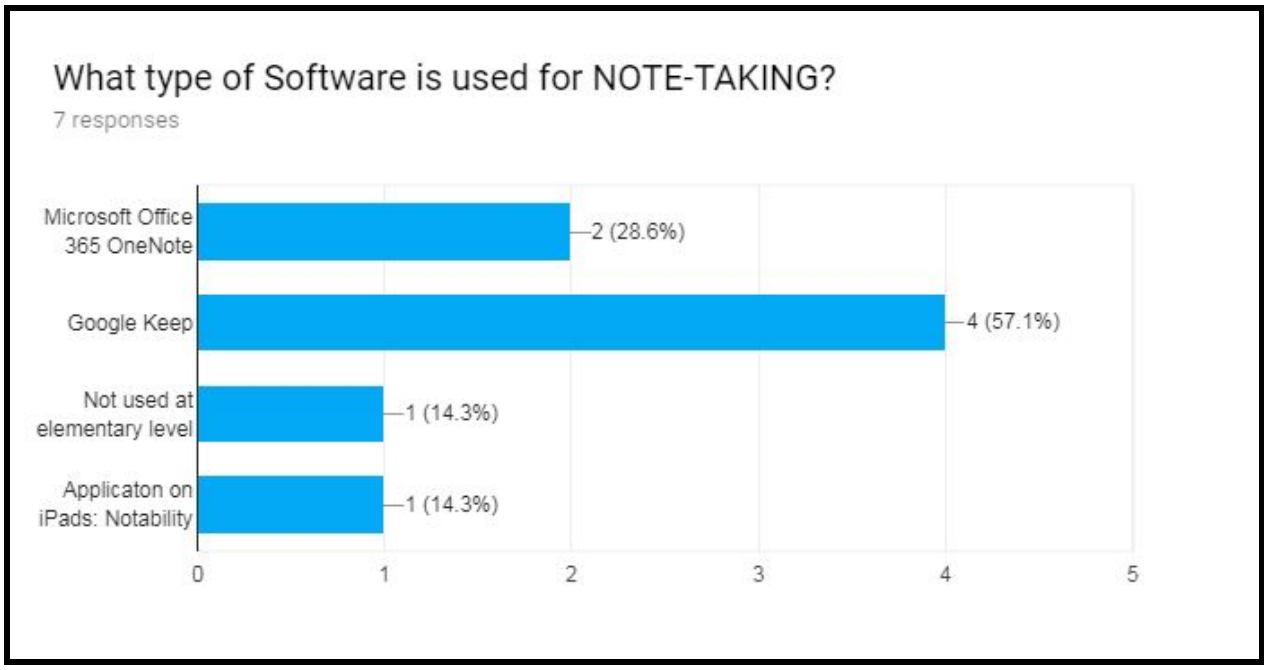
Graph 5A

Assistive Technology - Hardware

The LPS Research Group found that the majority of schools only use assistive technology when required by IEPs. These systems include assistive listening systems, sound-field systems sip-and-puff systems. However one school reported that every classroom is also outfitted with a device called the "Topcat," a surround sound, miniature PA system, that allows teachers to amplify their voice and even direct their speech at specific parts of the room, which is intended in part to prevent teachers from straining their voices

Software: Office/Productivity

The LPS Research Team found that 87.5% of schools used Google Drive as their primary software, while the rest used Microsoft Office 365. One school used Google Drive for their students and Microsoft Office 365 for their teachers. Most schools reported not using Microsoft Office 365 because of the high cost, over the Google Drive system. In the Google Drive software Google Slides are primarily used for presentations, Google Docs for word processing, Google Sheets for spreadsheets. Google Keep is the most used for note taking at 57.1% (see Graph 7A). All of these functions can be done through the Google Classroom feature.



Graph 7A

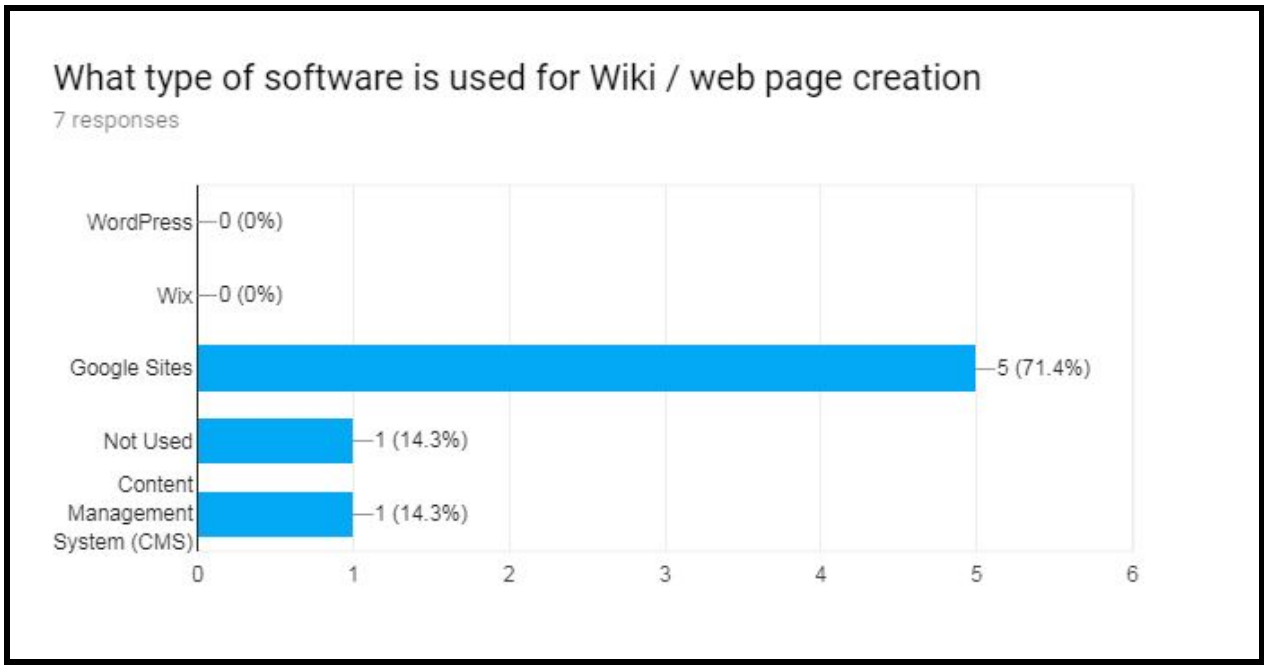
Software: Collaboration

The school districts also reported that file sharing and storage is also primarily done through the Google Drive software at 85.7%. Schools reported primarily using Google Hangouts software for instant messaging, video chat, etc, also at 85.7%. 71.4% of schools reported using

Youtube for video sharing and streaming in the classroom. Other systems schools reported using include Safari Montage Learning Object Repository and TeacherTube. The majority of schools report using Gmail, at 85.7%. However, two schools used both Microsoft 365 Outlook, and Gmail. These schools had their teachers using Microsoft 365 Outlook, while the students used Gmail. Only one school reported using Microsoft 365 Outlook as their email for both students and teachers. The majority of schools, 71.4%, use Google Calendar software for calendar/scheduling. Other softwares reported being used include scheduling services in GoGuardian software, and Microsoft 365 Outlook.

Software: Content Management

The majority of schools, 71.4%, reported to the LPS Research Team using Google Sites as their primary wiki/web page creation software (see Graph 8A). The majority of schools did not use software for blog publishing, however one school used Google Sites.



Graph 8A

Software: Learning Management and Virtual Classroom

The LPS Research Team found that that schools used different types of software for lesson plans, lesson content, learning/lesson management and electronic assignment submission including Aspen, Blackboard, Moodle, Schoology, and Google Classroom. Software LPS Research Team found that is used for SIS (Student Information System) for student attendance, registration, grading, transcripts, etc. includes Aspen, iPass, Power School and an internally developed and maintained student and employee information systems (see Graph 9A). The majority of schools do not use Virtual Classroom or Distance Learning technology, unless requested through IEP. The majority, 85.7%, of students can access at least some of their school accounts and resources from home (see Graph 9B).

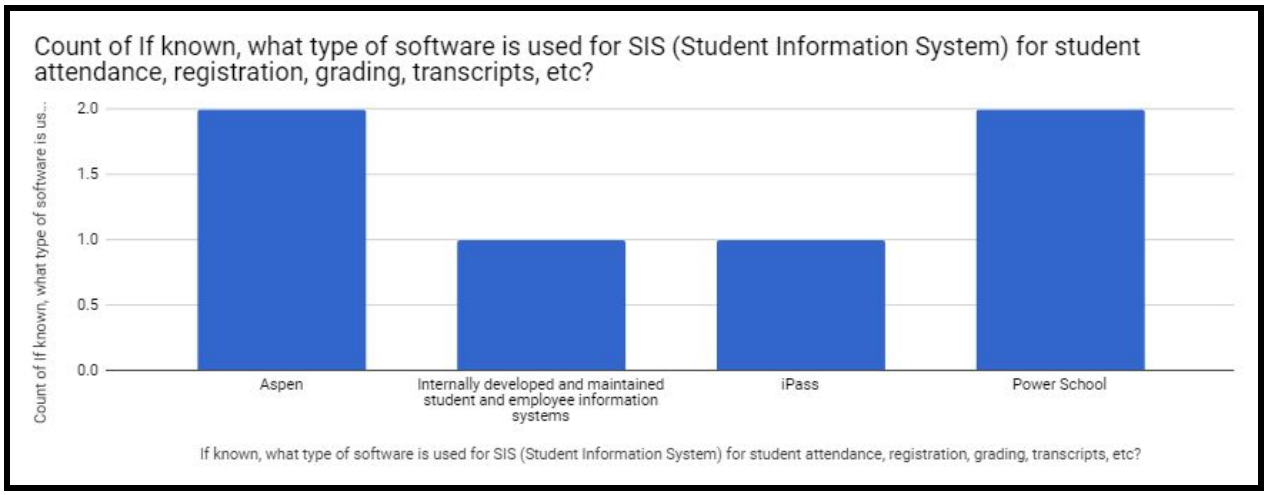
The LPS Research group also found that schools are using other educational software to add in the classroom learning process. There was no consensus on the best of these programming from schools, however for a list of software that schools are currently using:

Content Filtering Software
- Clever
- GoGuardian
- CIPA
- iBoss

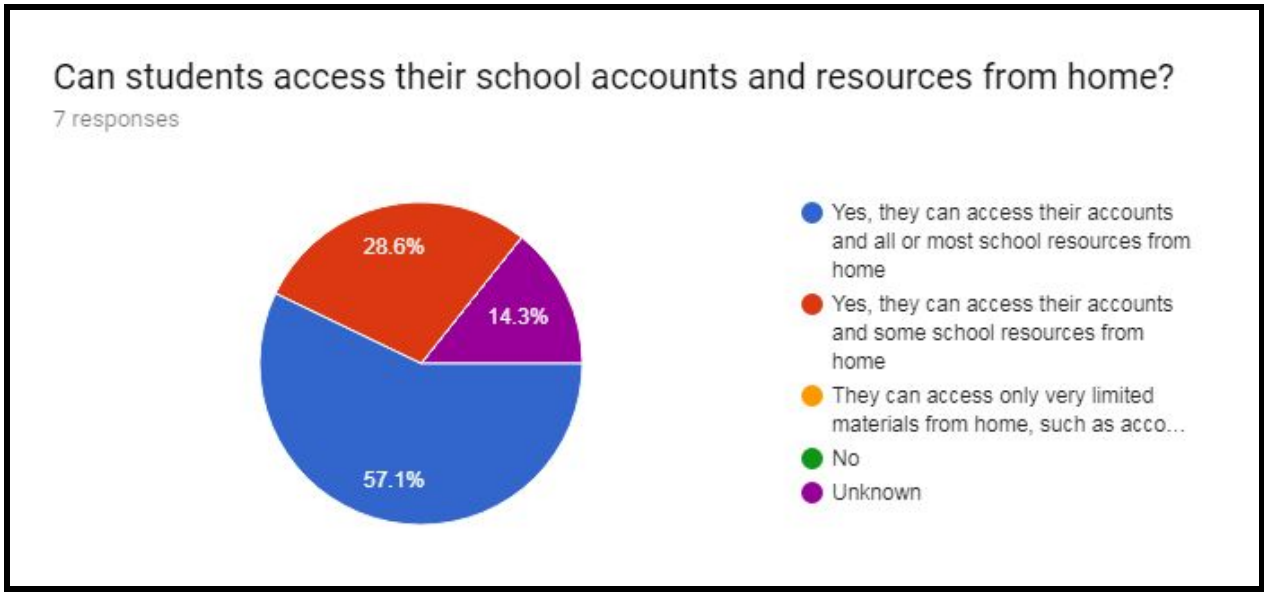
Student Information System
- Schoology
- Aspen
- Moodle
- Blackboard
- PowerSchool
- iPass

Extra Educational Program Software
- Literacy
    - Wonder
- Math

    - XtraMath
    - enVisionmath
    - ST Math
    - Zearn
    - Big Ideas
- Typing
    - Typing Club
    - Go Math!
    - Keyboarding without tears
- Science
    - iScience
- Multiple Education Subjects
    - BrainPop
    - Raz-Kids
    - Classflow
    - Lexia



Graph 9A



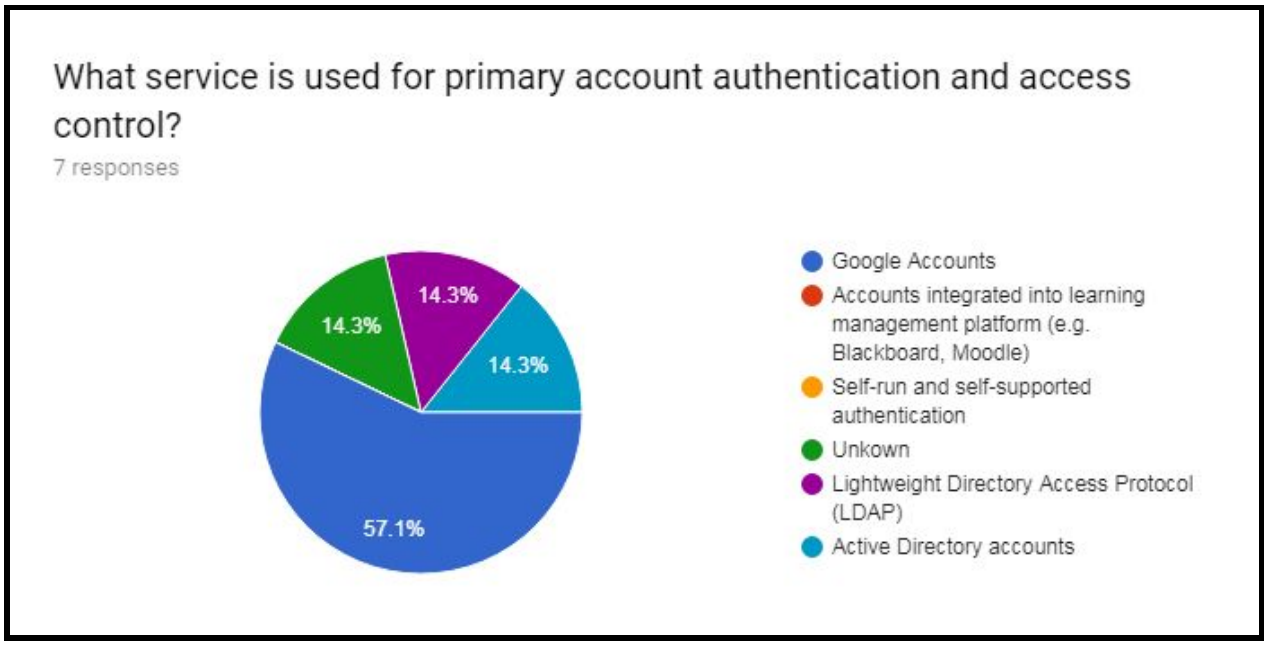
Graph 9B

Assistive Technology - Software

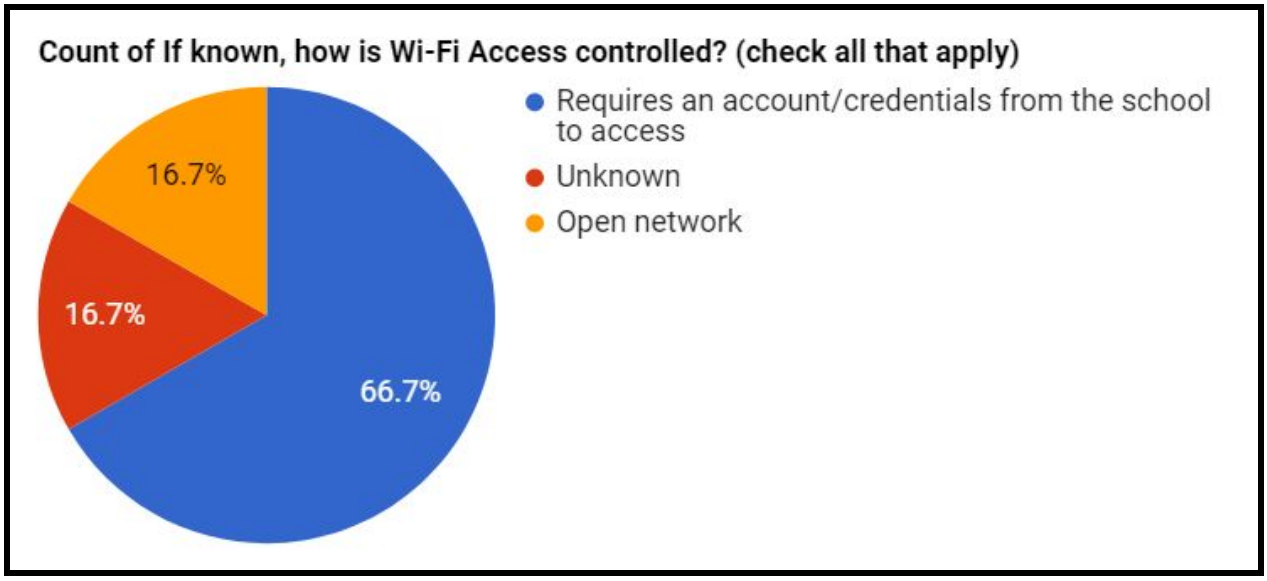
LPS Research Team found that most of the schools have access to assistive technology software, but the majority just use them as requested by IEP. LPS Research team found that Text-to-Speech (TTS) software was used in most classrooms for one school, but in 28.6% of other classrooms by request of IEP, and in other schools, not used at all. If TTS is used in many or most classrooms, schools reported using iPad's built in internal function. Screen readers, assistive proofreading software, beyond a typical spelling/grammar check, talking calculators and speech recognition software used are all either not available to schools or used by requirement of IEP. For speech recognition software two schools reported using Dragon Naturally Speaking.

Information Security

The LPS Research Team found that schools reported using Microsoft Security Essentials, Avast Antivirus, and eSet systems for antivirus and anti-spyware software. Schools reported using firewall software including GoGuardian, SonicWall, and iBoss. Schools reported using content filtering software including CIPA compliant web filtering, GoGuardian, iBoss, and SonicWall. The majority of schools, 57.1% use Google Accounts for their means of account authentication and access control. Nevertheless, Lightweight Directory Access Protocol (LDAP), and Active Directory accounts were also used (see Graph 10A). The majority, 66.7%, of schools interviewed required account/credentials to access the school's wifi (see Graph 10B).



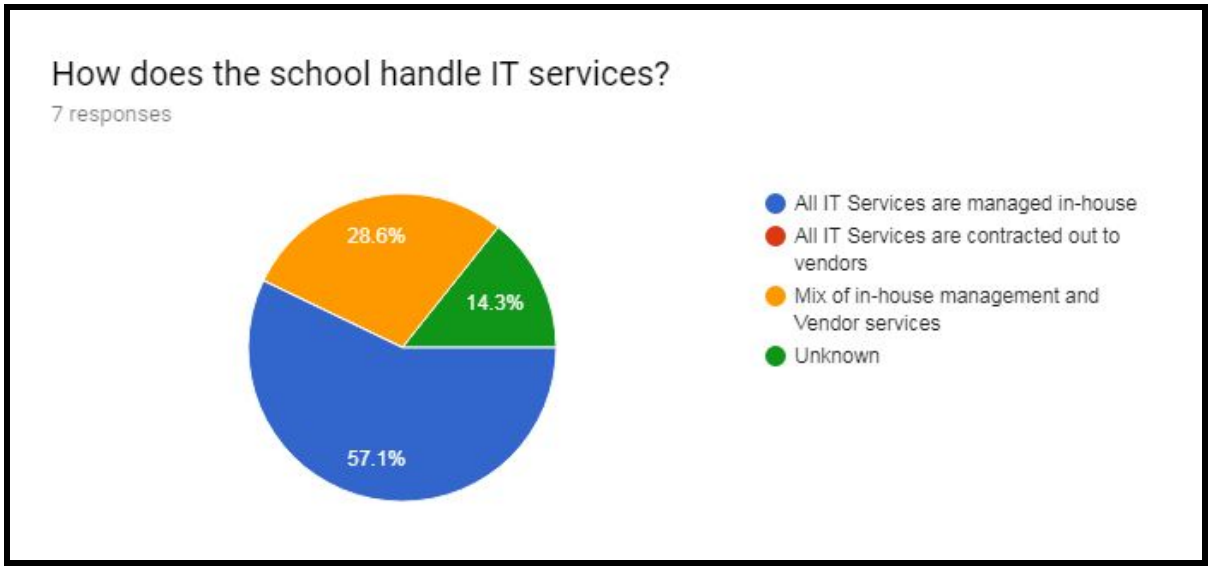
Graph 10A



Graph 10B

IT Services, Contractors, and Responsibility

LPS Research Team found the majority of schools surveyed managed all of their IT Services in-house at 57.1%, while 26.6% of schools had a mix of in-house management and vendor services, and finally 14.3% of schools did not disclose this information (see Graph 11A). If there were contracted services the companies used by the schools interviewed included AmComm Professional Services, MassCUE, and two districts used Aerohive. LPS Research Team also found that these contracted services either billed the district per user or per incident.



Graph 11A

Reflection

Leicester Research Capstone project was a very inspiring project regarding reflecting on current educational trends compared to going back in time. The goal of the project was to review and recommend education technology for the Leicester Public Schools, but it was also an excellent opportunity to go back to middle school times and consider the changes that were made and compare them to the times when we were in school at these levels. Although we are now surrounded by technology, not to say sometimes even overwhelmed by it, it was surprising to us that a lot of schools still use tools like whiteboards or even traditional chalkboards.

Even though the world absorbs the newest technology very fast there are still domains, like education, that implement the changes more slowly and stay somewhat behind. From our review, we found out that it is not only due to the issue of insufficient financial budgets. It is also about going through the generation gap concerning the teaching process.

Nowadays, children are consuming technology faster than adults, and in schools this can apply particularly to teachers. Due to that, the focus is the transition process for teachers that should be done to help them more efficiently use technology. Some schools during this project reported that their goal for the future is not to have even more technology but to focus on helping teachers fulfill their role. They are planning to create more training programs that will support them in better use of technology, so they can be on the same level as the children they are teaching. It gave us the reflection that in times dominated by technology sometimes it is more important to stop and adjust to what already was implemented and focus on the quality of it, even if it will mean you will stay behind a little bit. It is not always worth chasing the newest trends, as they will not serve the purpose they were chosen for.

Additionally, it is also crucial to mention that not only is technology going forward but also students' behavior, especially if we think about accessing and using information. For students, it is easy to go online and access or download materials to use in their homework and for studying. Some students are confused that copying and pasting is plagiarism because their source material did not have an author, and therefore may perceive that it was "common knowledge." Plagiarism is a big ethical issue, and teachers should reinforce how to cite authors, and why it's important to respect the intellectual property of others, which will help to minimize unethical behaviors occurrences

When approaching the Leicester Research Capstone Project, our team from the beginning shared enthusiasm and a straightforward plan for the implementation of the project. We immediately assigned roles and created a schedule for our project to have a full overview of our

scheduling. It was an idea shared by one of our members, who has professional experience in project management. He shared with us the experience that for any project timelines may shift when unexpected issues arise. It is best practice to create a timeline that over the project could be adjusted. It helped us to have an acute awareness of what needed to be done to have the project back on track after we approached obstacles.

As for the obstacles, the one that surprised us the most was the challenge of gathering data for the report. Mainly, it was the difficulty related to approaching the right people that could help us in this project. Sometimes it was a communication problem, for example choosing the right channel of communication when asking for help. We have created an extensive data collection form and instead of starting with direct contact with certain people, like a phone call or meeting to explain the purpose of this research and its importance, we made our initial contact through email. The outcome was that some of the contacted people got scared by our emails and did not feel comfortable sharing the data with us as they did not understand the goal behind it. This way of communication felt intrusive to them.

Another difficulty we encountered when contacting with our sources was the issue of being unknown and anonymous to them. It took as a lot of time to explain our reasons for contacting them, what kind of data we need and how we will use it, and in some cases still, we were not able to get support from them. When it became alarming because of our project schedule, we turned to our Capstone Advisor, and he gave us a hint of reaching out to people we know – for example, our professors in Clark University that might have connections with people we were attempting to contact. He encouraged us to use the power of networking instead of

moving alone. This kind of approach immediately opened a lot of doors, even more, that we needed.

This experienced gave us an ironic lesson because our project could be considered as a networking tool since we were preparing a recommendation report that will help the school in their building construction project, and recommendation is part of networking. It is about creating relationships and possibilities. While working on the project we forgot about these networking opportunities, even though we were doing a networking project for our client. We wanted to be independent, but achieving things together is more efficient than standing alone, and networking is the best example of how groups can excel in their cooperation.

When thinking about our team and our work together, even though we could not choose on our members of our team, we turned out to be a very proactive and high-performance group. What gave us the most substantial boost was this project's subject, as for our group it was a topic that lay outside of our typical daily responsibilities. It meant that we needed to go out of our safe zone and bring change into our knowledge, skills, and behaviors, since we needed to learn the topic from scratch to prepare a critical thinking and problem-solving recommendation.

Instead of just reporting on what is available regarding education technology for schools we have decided to build a framework that could be later reused. Technology evolves and changes very quickly and keeping that in mind we wanted to give a tool that will help Leicester Public Schools, and potentially other schools, in their project not only now, at this moment, but also in the future. This was the part of the Capstone project that we perceived as a development of our design thinking skills.

To conclude, the strongest reflections from this Capstone Project that will stay with us are associated with the following things:

- Sometimes staying behind does not mean we are not developing. There is more than one path of development – you can go upright, chase the latest trends and career advancement or you can go horizontally and focus on the quality of what you have already reached. That kind of approach in the future might even bring you more benefits as you gain perspective that may be missed while chasing the latest changes.
- When approaching a project, especially one within a very dynamic environment it is crucial to remember that sometimes it is not essential to find the right answer but to build a framework, design process that will allow you to find solutions now and later in the future. Such an approach builds in you better self-awareness not only in the subject you are working in but also in regards to your productivity.
- The significance of direct contact and communication, and the power of networking. Very often we forget about direct, personalized contact. It is easier to send just an email, but sometimes people may not understand our intentions. Still, it seems that the best way to communicate is to contact and talk directly with people. The reason is that during that we build a personalized relationship. It also confirms why still the most efficient way of learning is to have a teacher that can pass you the knowledge and explain it to you.

Summary Conclusion

Recommendations for Practice

In the course of the LPS Reseach Team's research and analysis, the team identified several areas where there was a strong consensus enabling us to provide specific recommended technologies. These technologies represent those that are employed successfully across multiple schools, and which were favored in the schools and districts that use them. The LPS Research Team is also able to provide specific recommendations in six main categories: infrastructure, devices, classroom technology, device policies, classroom software, and access.

Infrastructure	
Internet Backbone	Fiber Optic
Wi-Fi Access Points	1 per classroom, or according to recommendations of Wireless Network Architect
Devices	
Teachers	Windows Laptops/Notebooks
Students	Chromebooks
Purchasing	Leasing Program
Classroom Technology	
Classroom Display	Interactive Projector
Device Charging	Portable Charging Carts

Assistive Learning	Sound-Field System in every classroom; other technologies as needed per IEP
Device Policies	
Student Device Ratio	1:1
Take-Home Devices	Middle and High School students; all teachers
Replacement Cycle	Replace devices in annual cycle at specific grade-level intervals
Classroom Software	
Office/Productivity	Google Docs/Sheets/Slides
File Storage/Sharing	Google Drive
E-mail	Gmail
Access	
Wi-Fi Access	User Credentials Required to Access Network
Account Management	Google Accounts

Infrastructure

LPS Research Team is recommending a fiber optic backbone for the school's internet connection, in accordance with industry trends, and as it will most readily allow for an increase in bandwidth as the number of devices connected to the network at any given time increases. Several schools reported that after the completion of their new building or technology projects, enrollment at the school increased beyond initial expectations, as parents were eager to send their students to the new or upgraded schools.

In the schools we surveyed, we found that in most cases, every classroom or almost every classroom had a wireless access point. The precise distribution and placement of these devices should be in accordance with the recommendations of a Wireless Network Architect, pertaining to the specific plans for the new school building.

Devices

Based on feedback from the schools and districts we contacted, LPS Research Team is recommending that Windows laptops/notebooks are used for teachers. This recommendation is reflective of the need for teachers to install software, a reported difficulty for some teachers with the learning curve of using Apple/MacBook devices, and the consideration that some of the interactive projectors in use in classrooms work exclusively or work best when paired with a device that is running the Windows OS. Using laptops/notebooks instead of desktop computers also allows teachers the flexibility to take their devices home in appropriate situations.

Our recommendation for students, however, is that they use Chromebooks in the classroom. Among the schools we interviewed, Chromebooks were the favored device, even in schools where more than one device was used by students in the classroom. Chromebooks have the advantages of being relatively inexpensive compared to other classroom devices, integration with the G-Suite for Education, and being easy for students to use.

If possible, LPS Research Team also recommends that student devices be supplied through a leasing program, rather than purchased outright. This recommendation is based on feedback from schools that a leasing program includes replacement for defective devices, extended warranty options, and more support. When devices are purchased outright, any repair

or replacement not covered by the standard device warranty becomes the burden of the school's IT department, and may be costly in terms of both time and money spent. The LPS Research Team also recommends that Leicester Public Schools explores leasing options directly from Google and EPlus, as these were the companies uncovered through the research.

Classroom Technology

LPS Research Team recommends that an interactive projector be installed in every classroom. In the interviews we conducted, these were more widely implemented than interactive whiteboards and Smart TV units combined, and one school indicated that they would rather have purchased interactive projectors instead of the interactive boards they initially purchased, as the manufacturer of the boards went out of business and no longer supports the devices. Interactive projectors can be used on a blank wall, or on a plain whiteboard, which allows flexibility in the classroom layout, and they can be used with various smart devices, such as a stylus or mouse that integrate with the projectors.

To charge devices, LPS Research Team recommends portable charging carts, which can be purchased through a variety of standard purchasing channels for educational facilities. Each cart can hold and charge a classroom's worth of devices, and also can be locked to secure the devices. Having portable carts allows greater flexibility for classroom design and for sharing or trading devices between classrooms than the alternative stationary charging units offer. One school also provided feedback that it is best to purchase the carts pre-assembled, even if there is a discount for assembling them yourself, because the time and work required to do so outweighed the discount.

Most schools used Assistive Learning technologies as required by IEPs, but LPS Research Team did encounter multiple schools that had a Sound-Field System or similar PA system integrated into the standard classroom technology, and these schools reported it as beneficial to both students and teachers. These devices are used in the classroom to improve the sound environment, and in some cases to project the voice to specific parts of the room.

Device Policies

LPS Research Team found that the majority of schools interviewed either currently have a 1:1 ratio of devices, or are considering adopting this ratio in the future. As technology becomes increasingly prevalent in everyday life, our recommendation is for the classroom to reflect this, and provide enough devices for each student to use one. We also recommend that each device be assigned to a specific student, as schools we spoke to reported success with this model, and with having the students hold on to the same device from year to year.

Although we recommend allowing students to take their devices home, the schools we spoke to generally do not allow this practice with elementary school grades, and instead begin the practice at the middle or high school level. This practice helps to protect the devices from damage or loss that may be caused by younger students who are not used to having their own device to care for. For this reason, LPS Research Team recommends that middle school be the starting point for allowing students to take their devices home.

LPS Research Team also recommends that at least some devices be replaced every year, in order to keep up with current technology. Several schools reported success with a replacement model that replaces one grade level worth of devices every year, and cycles these devices up

with the students, and we recommend following a similar practice. This allows students to retain the device they are comfortable using, and also ensures that aging devices cycle out of use at an appropriate time. The leasing model of device acquisition that we have recommended readily supports a replacement cycle of this type.

Classroom Software

The LPS Research Team recommends the G-Suite, consisting of Google Drive, Docs, Forms, Sheets, Slides, etc. for office/productivity and file sharing software. This recommendation is based on information from schools that this free software package meets students' needs, is easy to use and integrate with other classroom technologies in place, and is a significantly less expensive option than Microsoft's Office 365.

LPS Research Team recommends using Gmail as well, for the reasons outlined above, and based on the feedback collected from schools. Gmail is generally easy to administer, and integrates well with the other G-Suite products used in the classroom.

Access

Based on implementations we found in the schools surveyed, the LPS Research Team recommends that wireless network access be controlled and secured by requiring user-specific credentials assigned by the school, rather than allowing an open network or a network secured by a single passkey.

LPS Research Team also recommends that account authentication be managed with Google Accounts, again due to the free software available for educational settings, and the ease of integration with other classroom technologies.

Conclusion

Overall, LPS Research Team found that G-Suite for Education was preferred over Microsoft Office 365 for Education among the schools we surveyed, largely due to the high costs associated with licensing Office 365 for the number of users in the school.

An additional pattern of preference emerged when we aggregated the data from the schools we visited in the recommendation of Chromebooks over other available classroom devices, such as MacBooks or tablets. Again, the Chromebooks are a less expensive option, and we received information that teachers and students who used both Chromebooks and tablets in the classroom had provided feedback that they preferred the Chromebooks for use as their everyday classroom device, in part due to the physical keyboard. In schools that used MacBooks, it was noted that some teachers had difficulty adapting to the devices if they were previously unfamiliar with them.

These recommendations, and all recommended devices and practices outlined above reflect the product of the research that the LPS Research Team conducted by interviewing representatives of seven comparable schools and districts in Massachusetts. In coming to these recommendations, we looked at the frequency of implementation of the specific technologies, as well as taking into account feedback provided to us on how successfully these technologies have been implemented and adopted by students and teachers in the schools.

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Appendix A - Project Charter

CLARK UNIVERSITY

CHALLENGE CONVENTION.
CHANGE OUR WORLD.

School of Professional Studies

Project Charter

Leicester Research Capstone

Table of Contents

Glossary of Terms

Assumption: An item taken to be factual even though that fact has not been confirmed. Wherever possible the accuracy of assumptions is validated during the project

Constraint: An unchangeable condition that impacts the project.

Contingency: An activity, budget or time period that is held in reserve in order to minimise the impact that a risk has on the project if that risk is realised

Major Stakeholder: One of the key interested parties and decision makers in the project.

Mitigation: An activity that is undertaken to minimise the impact and /or the likelihood of occurrence of an adverse risk or to maximise the impact and /or the likelihood of occurrence of a positive risk

Project Charter: This document. The document that authorises the project and sets out the framework for what is to be done and how it is to be managed.

Project Manager: The person responsible for the management of the execution of all work items.

Required End State: The definition of what constitutes a completed project.

Risk: An uncertainty that may impact the project in either a positive or negative manner if it occurs.

Scope: The sum of the changes to be made in order to achieve the Required End State.

Steering Committee: The group of people responsible for making major decisions on the project.

1 Project Overview

1.1 Introduction

Leicester Public School will be constructing a new elementary school to facilitate the growth of students in Leicester. They would like to incorporate innovative technology to enhance learning experience beyond classroom.
The project team has been assigned with tasks of:

- Researching new educational technologies
- Researching the technologies used in the neighbouring schools
- Evaluating various vendors and their services
- Researching various training program that can enhance the user ability
- Recommending the best solution that will support their mission and vision

The objective of this project is to recommend solution that proves to be the best for them and they accept it.

1.2 Major Stakeholders

Project Sponsor & Key stakeholders	Title	Organization
Jeffrey Berthiaume (Project sponsor)	Director of Technology and Digital Learning	Leicester Public Schools
Jeffrey Berthiaume (Project leader)	Director of Technology and Digital Learning	Leicester Public Schools
Technology Steering Committee	Steering Committee	Leicester Public Schools
Community	N/A	Town of Leicester
Richard Aroian	Master Program Advisor	Clark University
Project Team	Capstone team	Clark University

2 Project End State and Scope

2.1 Required End State

A fully detailed technological solution recommendation with vendor contract evaluation, specification, costs, and types of services offered to leverage the educational experience beyond classrooms

2.2 Project Scope

Provide well researched technological solutions for the new elementary school before the end of May 2018. This project will facilitate easy learning through the effective use of technology beyond classroom. The final document will have the best solution recommended from the list of many evaluated solutions.

Work Area	In Scope	Out of Scope
Research	Surrounding school's technological implementations and use	
Evaluation	Identifying and evaluating many well known vendors to determine the best possible solution	User, and data privacy
Designing	From the research conducted, the final document will be developed with detailed implementation guidelines	Implementation of the actual project
Research	Well known technology from reputable vendors with future scalability	Maintenance and user training
Reporting	Milestones reporting would be conducted and sent to Mr. Jeffrey Berthiaume	Weekly reports

2.3 Change Management

2.3.1 Change Management Policy

This section details how requests for changes to the project criteria, scope, time or budget will be submitted and assessed.

This section of the document refers to changes requested after the initial Project Charter sign off is completed by all parties.

The procedures defined below will be used to evaluate and make decisions on proposed changes to the project's baselines, and will cover the process from end-to-end, including submission of a request for change, justification, categorization, evaluation, and decisioning.

The Change Manager is responsible for updating the Change Log throughout the Change Request process and communicating these changes as applicable to Project Team, Stakeholders, and Project Sponsor.

2.3.2 Change Management Process Flow

The steps below will be followed for each Change Request:

ID	Step	Description
1	Change Request	The Change Request Form is completed in full by the party proposing a change to the project's established baselines. This form should include a description of the change requested, the nature of the change, how it will affect the project's deliverables, and a justification supporting the change's importance to the project
2	Change Log	The requested change will be entered into the Change Log by the designated Change Manager; this will be updated as the change is evaluated and potentially implemented.
3	Change Evaluation	Project team (and stakeholders, if applicable) will discuss and evaluate the impact of the requested change to the project, devising an estimate for the impacts to the scope, time, budget, deliverables, etc.
4	Change Authorization	Based on the details of the request and the information given during the Evaluation phase, the Project Manager determines whether the change is Approved, Approved with Conditions, Deferred, or Denied
5	Change Implementation/Wrap-Up	The Change Status should be noted in the Change Log. If the change was Approved or Approved with Conditions, implementation will begin. If it was deferred, criteria for reconsidering should be described in the Change Log. If Denied, a reason for denial should be given.

2.3.3 Change Management Request Form

The Change Management Request Form can be found in Appendix 1A. This form should be completely filled out for all change requests that affect the project's scope, time, budget, and/or deliverables.

2.3.4 Change Management Log

The Change Management Log will be used to track all Change Requests. The included fields of the Change Log and a brief description of each field follows:

Field Name	Description
Change ID	The Change ID number, will be assigned sequentially as each Request is logged.
Date Requested	Date of submission of Change Request Form
Change Name	Title/Name of Change being requested
Description	Brief description of what is being requested, summarized from Change Request Form
Impacts	In what ways and how significantly will this affect project time, budget, scope, or deliverables?
Priority	How urgent is the change request to the project?
Approval Status	Approved, Approved with Conditions, Deferred, or Denied
Reason for Status	Justification for the Status, including Conditions if applicable, or circumstances under which a Deferred change will be reconsidered.
Next Steps	What must be done next to advance the change. If the change is in progress, what is currently being worked on?
Due Date	The target due date for the Next Steps given above
Final Resolution	Final status of Change Request, how it was resolved/implemented if applicable.

2.3.5 Change Management Approval Status

The Project Manager will determine the Approval Status after discussion and evaluation. The Change Manager is responsible for communicating this change status to the client, if applicable. Below is a description of each of the four possible Approval Statuses:

Status	Description
Approved	The change is approved as written on the Change Request Form.

Approved with Conditions	The change is approved, but in order to mitigate impacts on project baselines, conditions are imposed or added
Deferred	The change is not approved at this time, but it may be considered at a later time based on specific criteria or needs
Denied	The change cannot be approved due to constraints on budget, time, scope, or deliverables that cannot be reasonably overcome, or the priority was not high enough to justify the impact

3 Assumptions

The LPS Research Team is making some assumptions in regards to completing this project, they include:

- Assumptions regarding the LPS Research Team's position:
    - All LPS Research Team members will contribute to the project in anyway that they can
    - All LPS Research Team members will complete their project responsibilities in a timely manner, causing the project to be completed by the presentation date
    - All LPS Research Team members will openly communicate with one another, the project advisor and the Leicester public school about the project
- Assumptions regarding LPS Research Team's Advisors position:
    - The advisor will be available to meet and communicate with the LPS Research Team
    - The advisor will be willing to help guide the team in any means necessary
- Assumptions regarding the Leister Public School System position:
    - The LPS will grant the LPS Research access to information about the new school project including the Educational Draft Plan.
    - The LPS will be open to communicating with the team about any questions or concerns in a timely manner.
    - The LPS will understand the and agree to the scope of the project and the constraints around it.
    - The LPS does not have any contractual obligations with technology vendors that will interfere with the new school project.
- Assumptions regarding outside school system research:
    - Other Massachusetts school districts will be communicative and willing to discuss their classroom technology plans
    - At least 5 other school districts in Massachusetts have upgraded their technology in the past few years
    - There are other Massachusetts school districts around the same size fiscally and demographically that have upgraded their technology in the past few years.
- Assumptions about technology vendors:

- Vendors will be willing to share their prices for aq public school system with the team.

4 Constraints

Some limiting factors for this project may be:

- *Time* - Final presentation must be made by LPS Research Team in April.
- *Money* - The LPS Research Team has no access to money for project purposes.
- *Budget*- There is not a clear budget for the Leicester public school technology investment, which may be difficult for the team to give recommendations that fit within their means
- *Unrealistic Client Expectations* - The client may expect us to complete more work then we are able in the time allotted
- *Lack of in Person Availability*- The LPS Research Team will be meeting mostly virtually, which may be a difficult for some aspects of the project.
- *Connecting with Other School Districts* - It is imperative for this project the LPS Research Teamable is able to talk to other school districts about their technology, however the team does not have control over weather or not the school districts respond, the timeliness of their responses, or the relevance of their responses
- *Competing Priorities* - LPS Research Team has competing priorities with other classes and work responsibilities.

5 Risks

The main risks in this project relate to the acquisition of valuable, usable, and timely information, as well as the buy-in of stakeholders and users, including approval of funding by the community, and engagement of users in learning and using the implemented technology. Significant identified risks are outlined in the table below, along with a severity score based on impact and likelihood of risk, and mitigation actions are also identified to minimize each identified risk.

ID	Risk Item	Effect on Project Success	Cause	Severity	Action to Mitigate/Minimize Risk	Owner
1	Some towns/schools may be unwilling to discuss details of recent or planned projects	Insufficient research information available to base technology recommendations, experiences, and expected costs from	School or town officials may be unwilling to share data, or may not have time to properly answer all of our team's research questions	High	Since we ideally need 3-5 schools or towns to respond with good data and information, we will overshoot and attempt to contact 8 towns/schools with similar projects in progress or recently completed	Project Team
2	Community may not immediately buy in to project scope and cost	The project cannot move forward without community approval	The community is a key stakeholder and will need to approve funding for this project	High	Value add of the project to the community must be presented clearly; additional financial support covered in Project Assumptions	Stakeholders
3	Users (teachers and students) may not buy in to new technology plan if it is too complex or does not offer enough value	If the users do not engage with the new technology, it will be under-utilized and potentially wasted	Change is met with resistance if the value is not clear or if the learning curve is too steep	Moderate	Proven, trusted technologies with robust vendor support and training options will be targeted and prioritized	Project Team
4	Users must be online to utilize the devices and network(s)	Internet outages, downtime, or bandwidth issues will prevent the users from accessing and using the systems and tools in place	Services all require internet connectivity, particularly cloud-based and third-party authentication services (e.g. Google accounts)	Low	Reliable internet connection is available in the area; onsite staff can deal with equipment problems quickly; current bandwidth is adequate, and a plan for increasing bandwidth in the future is within stakeholders' sights	Stakeholders

5	Limited staff and budget available to support new equipment	The technology plan proposed must be manageable by the current support staff	Supporting staff for technology is a small group and it is not within scope or budget to acquire additional staff to support the new technology plan	Low	Cloud and managed services are readily available and will eliminate the need to hire additional supporting staff or to invest significantly in new servers, etc.	Project Team/ Stakeholders

6 Communication Strategy

6.1 Communication strategy plan objectives

1. To create consistency in the messages and information shared during the project to maintain any possible confusion.
2. To ensure productivity and efficiency among project team members.
3. To secure the commitment of stakeholders to the project goals.
4. To support the overall visibility of the project for the stakeholders and project members.

Project communication strategy will be working on two levels:

1. Internal communication - is intended to ensure a constant and effective exchange and share of information between project team members (communication through instant messaging tools, exchange of emails, meeting if required). It also should enable to manage and share knowledge gained and generated by project activities.
2. External communication – It is intended to bring update to the stakeholders on planned actions and its deliverables to achieve the same understanding of project goals. Project's success depends on the strength and good cooperative relationship with the stakeholders of the project.

6.2 Structure of communication strategy plan

Informal communication:

1. Team Meetings;
2. Weekly Status Reports;
3. Instant Messaging (Hangouts);
4. Emails;
5. Online Drive (Google).

Formal communication:

1. Project Charter;
2. Monthly Reports;
3. Meetings with Stakeholder;
4. Meetings with Capstone Project Advisor;
5. Performance Evaluation;
6. Final Presentation;
7. Final Report.

Informal communication is dedicated for internal purposes of the project and formal communication serves external relationships in the project.

6.3 Changes to the communication strategy plan

Evaluation and changes of the communication strategy plan will be made if during the course of the project Project Manager or any other project team member notice inconsistency or communication issues will impact project delivery. When this will be reported there should be scheduled a team meeting, no later than week from reported issue, that will review current communication strategy plan and adjust it to new situation.

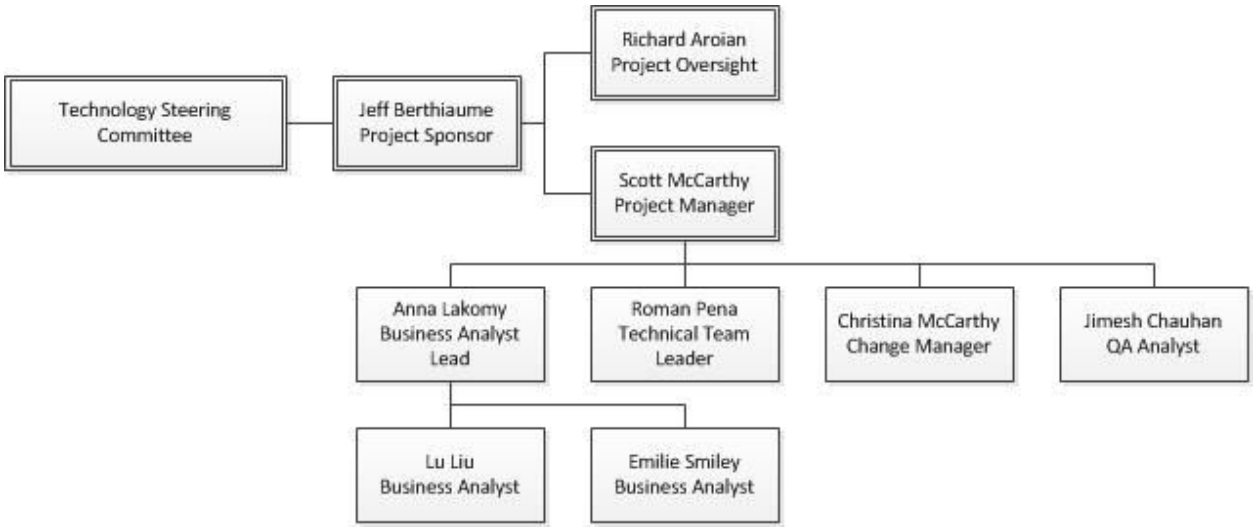
6.4 Detailed communication strategy plan

ID	Communication Type	Owner	Message	Audience	Frequency
INTERNAL COMMUNICATION					
1	Team Meetings	Project Manager	Scheduled for task assignment, review of progress in project milestones.	Capstone Project Team	Bi-weekly
2	Weekly Status Report	Project Manager	To ensure that all tasks has been assigned and every member of the project team is aware of its tasks. To manage the workflow between project team members. Data for Monthly Reports.	Capstone Project Team, Capstone Project Oversight	Weekly

3	Instant Messaging	Capstone Project Team	Mainly for instant collaboration. Discussion on current workload on the project or issues that showed up in the project.	Capstone Project Team	As needed
4	Email	Project Manager	To send reports, team meetings invitations, share documents, updates.	Capstone Project team, if required Capstone Project Oversight	As needed
5	Online drive	Capstone Project Team	Archive for gathered knowledge and documents. Assuring consistency in the documentation and understanding of the project goals.	Capstone Project Team	As needed
EXTERNAL COMMUNICATION					
1	Project Charter	Project Team Members	Summary and presentation of project deliverables to the Stakeholder. Expressing the goals of the project.	Stakeholder and Capstone Project Oversight	Once, at the project kick-off
2	Monthly Reports	Project Manager	Summary of current activities and stage of project milestones.	Capstone Project Oversight	Once a month
3	Meeting with Stakeholder	Project Manager	Inform about current progress in the project, review deliverables to check whether agreed goals in the beginning of the project are still valid.	Project Manager and key Stakeholders and Project Team Members as needed.	Monthly or after any significant milestone
4	Meeting with Capstone Project Advisor	Project Manager	Consulting current progress in the project, literature demand completion, discuss challenges/issues that project is facing.	Project Manager and Project Team Members as needed.	As needed
5	Performance Evaluation	Capstone Project Team	Sharing experience and reflections on teamwork in the Capstone Project.	Capstone Project Oversight	Twice during the project

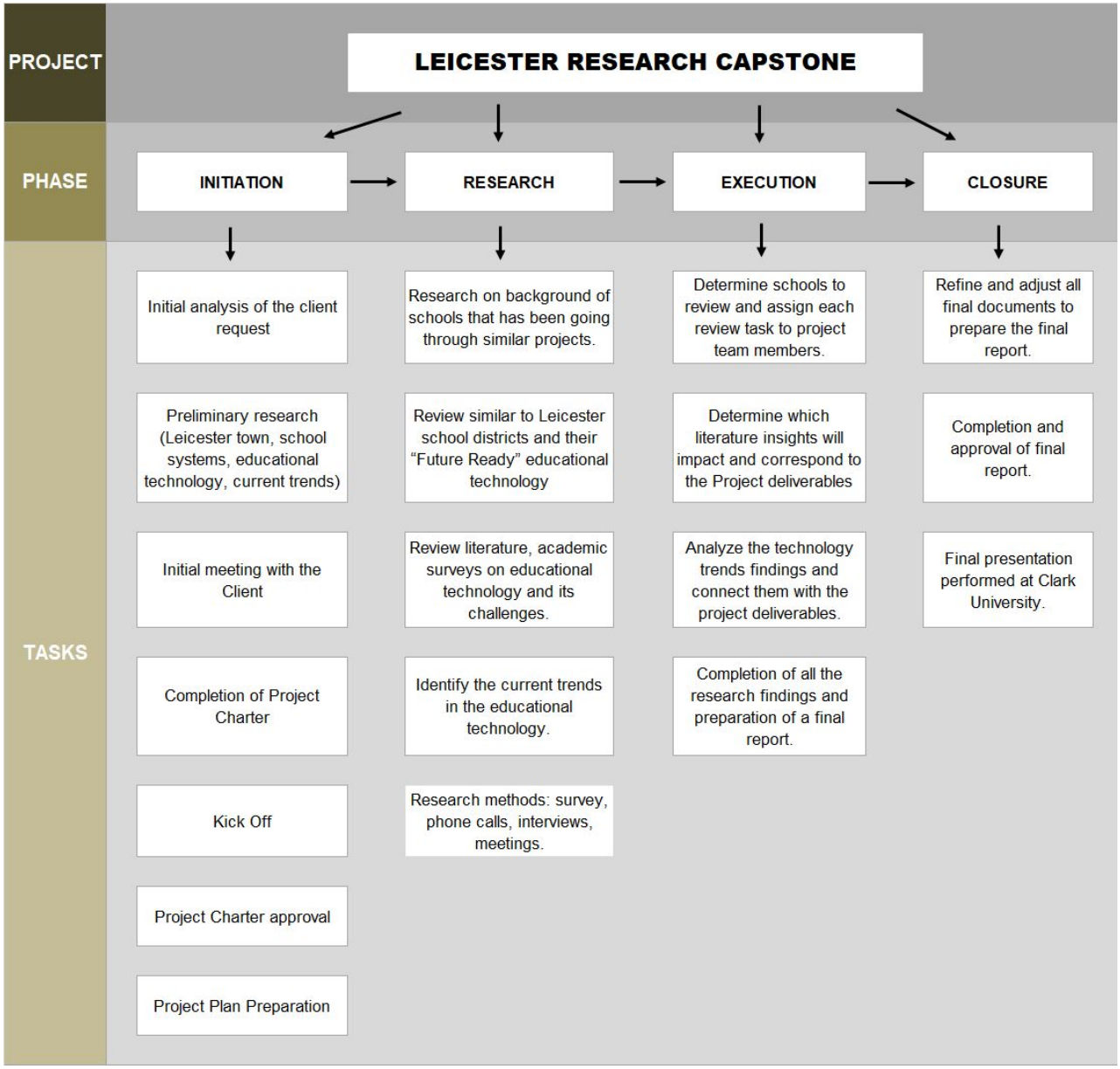
6	Final Report	Capstone Project Team	75 to 125 pages report on Capstone Project with its deliverables and recommendations.	Stakeholder and Capstone Project Oversight	Once at the end of the Capstone Project
7	Final Presentation	Capstone Project Team	Presentation summarizing the research and finding delivered in Capstone Project	Project team, Stakeholder and Capstone Project Advisor	Once, as finalization and closure of the Capstone Project

7 Project Structure



7.1 Work Breakdown structure

The overall approach for the project will follow a phased or waterfall model through an iterative review and refinement process. The major steps are presented on the work breakdown structure diagram:



8 Steering Committee and Stakeholder Commitments

8.1 Steering Committee (if applicable)

Leicester Public School

8.2 Stakeholder Commitments

- **Leicester community.** The decider and provider of project funding.
- **Jeffrey Berthiaume.** The Director of Technology and Digital Learning in Leicester Public Schools. He is the project sponsor and leader.
- **Teachers and Students.** The users of the technologies.
- **Richard Aroian.** The Master Program Advisor
- **Capstone Team**. The members of Leicester PS Research project.
- **School of Professional Studies**

9 Resource plan

9.1 Roles and Responsibilities

Team Member	Project Role	Responsibilities
Richard Aroian	Project Oversight	● Provide overall project leadership and oversight from a solution delivery perspective
Jeffrey Berthiaume	Project Sponsor	● Maintains project alignment with Leicester schools strategy ● Recommends opportunities to maximize cost/benefits ● Provide feedback on Project Charter ● Provide sign-off on Project Charter ● Approve/Deny change management requests ● Sign-off on final project completion ● Provide feedback and lessons learned
Scott McCarthy	Project Manager	● Coordinate all phases of the project ● Coordinate development of project charter ● Create and update project schedule ● Coordinate all efforts and communications on the project ● Oversee completion of the project ● Participate in team work sessions
Anna Lakomy	Business Analyst Lead	● Provide team with oversight, guidance and support ● Communicate change management issues to project management ● Responsible to communicate milestone status to Project Manager

Li Liu, Emilie Smiley	Business Analyst	● Participate in team work sessions ● Participate in the development of the project charter ● Contribute to project planning activities ● Creation of detailed requirements ● Performs researches, interviews and other information gathering on the different K12 schools ● Responsible to communicate milestone status to Project Manager
Roman Pena	Technical Architect/ Technical Lead	● Participate in team work sessions ● Communicate change management issues to project management ● Provide guidance and support on the research activities ● Assists with technical evaluation of the different school's technology platform ● Responsible to communicate milestone status to Project Manager
Christina McCarthy	Change Manager	● Participate in team work sessions ● Communicate change management issues to project management ● Responsible for updating Change Log ● Evaluate impact to project baseline of proposed Change Requests ● Facilitate discussions regarding Change Requests
Jimeshkumar Chauhan	QA Analyst	● Participate in team work sessions ● Communicate change management issues to project management ● Validate that client expectations are achieved during the different phases of the project. ● Review the deliverables produced by the team to ensure they have the appropriate quality standards

9.2 RASCI Chart

	Roles / Responsibilities				
Process or Activity	Project Sponsor	Project Oversight	Project Manager	Project Team	Client Organization
Initial research and preparation		I	A	R	I
Project Charter	S	I	R	C	I
Project planning and coordination	C	C	R	C	C
Project communication	I	C,I	R	C,I	C,I
Problem identification and analysis	I	I	A	R	C
Conflict/problem resolution	C	C	R	C	C
Preparation and distribution of the school research activities	I	I	A	R	C
Execution of the technology research on identified schools	I	I	A	R	I
Results, conclusions, final reports, paper and required documentation	I	I	A	R	I

R – Responsible: Performs the work
A – Accountable: Ensures that the work is completed (escalation point).
S – Sign-Off: Approves or sign-off the work.
C – Consulted: Is consulted on/contributes to the completion of the work.
I – Informed: Receives the output of the work and/or receives status reports on the progress of the work.

10 Measures of Success

Project outcomes, benefits, objectives	Measure of Success
Provide Leicester Schools with a classroom technology reference solution for the new building project	The customer (Leicester Schools) should received a final report outlining the more appropriate technology solution
Investigate from five to eight schools in the area looking for software, hardware, infrastructure, networking and any classroom technology component used by those school	The project's deliverables must include all collected findings for each school. Leicester Schools can use the information as a reference guide for decision making during the new building project
Compare and evaluate the different educational technologies found during the research	Provide evaluation results indicating what are common, proven and state of the art technologies currently used in K12 school's classrooms
Meet agreements, expectations and customer success	The effort should finished on time and in budget, the client organization must be satisfied with the final deliverables
Project Team satisfaction and professional growth	An engaged, motivated and committed team during the duration of the project. Each member will contribute value to this endeavour in order to accomplish a great Capstone project.

11 Preliminary work effort and timeline

Activity	Start Date	End Date
Preliminary research and preparation	**1-17-18**	**2-5-18**
Project Charter	**2-5-18**	**2-15-18**
School research and information gathering	**2-15-18**	**3-9-18**
Analysis of research results, technology evaluation	**3-10-18**	**3-30-18**
Final report and documentation	**3-31-18**	**4-23-18**
Final presentation	**3-31-18**	**4-23-18**

12 Stakeholder Sign-off

This project charter has been signed off by the following stakeholders:

Name	Title	Date
Jeffrey Berthiaume	Project Sponsor	

Project Teams Members:

Name	Title	Date
Jimeshkumar Chauhan	QA Analyst	
Ana Lakomy	Business Analyst Lead	
Li Liu	Business Analyst	
Christina McCarthy	Change Manager	
Scott McCarthy	Project Manager	
Roman Pena	Technical Team Leader	
Emilie Smiley	Business Analyst	

Appendix 1A: Change Request Form

Leicester Research Capstone Project
Change Request Form

Date:					Date Rec'd:	
Name of Requestor:					Rec'd By:	
Name of Requested Change:					Date Logged:	
Detailed Description:						
Priority:	Low	Medium	High	Critical		
Justification, or Why is This Change Being Requested?						
Additional Comments (optional)						

Appendix B - School Contact Chart

Below please find a chart of the LPS Research Team's initial research and criteria for reaching out to school districts.

Name of Group Member	School District Name	Year of Upgrade	Size of School	Type of School	District Budget	Project Budget	Source of Data
Jimesh/Scott	Franklin	2014	1739	Franklin High School	$74,800,000	$103,513,848	("Franklin public schools," n.d.)
Christina	Webster	Project in Closeout stages now (2018)	510 students (old school; new school 800)	Elementary (Park Avenue Elementary School)	$28,200,000* (2016 data)*	$43,329,436	(Webster, MA official website, n.d.) (Webster public schools, n.d.)
Jimesh	Lynn	Project completed 2016	1,001 students	Thurgood Marshall Middle School	$138,500,000	$92,000,000	("Lynn public schools," n.d.)
Anna	Auburn	Project in Closeout stages now; School opened in 2015	580 students	Auburn Middle School	$32,800,000	$41,654,123	("Auburn public schools," n.d.)
Scott	Douglas	Multiple projects	1471 students in district	Repair of Intermediate Elementary; New Elementary School	$18,800,000	$32,231,824 (Elementary) $17,400,803 (Middle School repair)	("Douglas, MA official website," n.d.)
Emilie	Lowell	New Project		New High School Building	$149,000,000	$336,000,000	("Lowell public high school," n.d.)
Roman	Worcester	New Project	494 students	Nelson Place Elementary School		$58,000,000	("Nelson Place Worcester Public School," 2018)
Li	Shrewsbury	2013-15 school improvement plan 15-17 school improvement plan	985 students	Sherwood Middle School		$43,947,705	("Shrewsbury public school," n.d.)

General research sites used: (U.S. Census Bureau, 2010), (“A guide to the Massachusetts,” 2013), (“Massachusetts school and district profiles,” 2018), (“Massachusetts school building authority,” 2011)

Appendix C - New Elementary School Project. Classroom Hardware Costs

Device	Count	Cost per unit	Total
Teacher iPads	53	$ 393.00	$ 20,829.00
Student iPads	210	$ 393.00	$ 82,530.00
iPad Carts	7	$ 1,499.95	$ 10,499.65
Apple TVs	60	$ 99.00	$ 5,940.00
Teacher laptops	63	$ 495.00	$ 31,185.00
Student laptops	120	$ 495.00	$ 59,400.00
Laptop carts	4	$ 1,800.00	$ 7,200.00
Document cameras	56	$ 340.00	$ 19,040.00
Interactive projectors	56	$ 1,175.00	$ 65,800.00
		Grand Total	$ 302,423.00

APPENDIX D - FRAMEWORK

APPENDIX D - FRAMEWORK

Framework for Research of Technology for Education

Contents

Overview

This framework was developed to help the Leicester Research team uncover the existing trends in technology in the classroom. We include questions to uncover what is successful, what is not successful, and all technology that is used in classrooms today. This framework was designed to interview Technology Directors of school districts which recently complete a large capital project such as a new school or major renovation.

Coversheet

School district name:	
School name:	
Type of school:	
Size of school:	
Year of upgrade:	
District's budget:	
Project's budget:	
Contact person:	

School Research Questions

1. What was your budget/portion of your budget for education technology?

2. What technology do your classrooms currently have? (What devices do your students use in the classroom?) (*we can fill in the Education-technology-Inventory-Template for this question*)
a. Chromebooks
b. Laptops
c. iPads
d. Projectors

2. Does the technology allow off-premise learning and collaboration? (Can students/teachers log in to the school's resources from home)?

3. What is your student-to-device ratio with your new technology plan? (e.g., 1:1, does every student have a device?) What device ratio do you think is reasonable for the different grades? （eg., For K-2, tablets ratio is 1:3, and laptops ratio is 1 cart/5 classrooms?）

4. What are your replacement cycles with your plan, and if so, what is it?

5. What company did you use to provide this technology? Do the vendors have a good support team? Do they ever come on-site if the issue is bigger?

6. How are students authenticated when accessing their devices in the classroom? I.e. Do they log into a school portal, use Google Accounts, etc.?

7. Do you have any qualms/challenges with your current technology, or anything you would have done differently?

8. Any issues with rollouts of new devices or technology?

9. What are the best three types of technology you invested in and why?

10. How did students and the staff adapt to the new technology?

11. Is there any technology you regret buying?

12. What typical vendors do you use for online collaboration and student account platform?

13. Do you have an in-house IT team that troubleshoots the issues before contacting the vendors?

14. Is the technology scalable? For instance, if you need to support 100 more students, will the technology allow it?

15. What's the feedback and suggestions about the tech from users (teachers and students)?

16. How do you encourage the parents to set home standards and to provide resources for parents to help students to use device at home?

17. What's the plan for desktops?

18. How do you balance the numbers of tablets and laptops?

19. How did your team research the best-fitting technology solutions for your school in the planning phases of the project?

Educational Software

Software Type	Description	Software used by the school (include version)	Manufacturer	Delivery Model (SaaS, PaaS, On-premises)	Licensing Model (Perpetual, Subscription, Usage)	Version
Office Software						
Word processor	Allows manipulating and editing text, also includes others features such as; built-in spell checker, thesaurus, dictionary, templates, macros, bullets and numbering, etc. (e.g. Google Docs, Microsoft Word)					
Spreadsheet	Allows organization, analysis and storage of data in tabular form. Each cell may contain either numeric or text data, or the results of formulas that automatically calculate and display a value based on the contents of other cells. (e.g. Google Sheets, Microsoft Excel)					
Presentation	Software that allows to display information in the form of a slide show. Commonly includes an editor that allows text to be inserted and formatted, a method for inserting and manipulating graphic images, and a slide-show system to display the content					
Notetaking	Note taking software allows individuals to record, organize, and file important information in a single place (e.g. Google Keep, OneNote)					

Educational Software (continued)

Software Type	Description	Software used by the school (include version)	Manufacturer	Delivery Model (SaaS, PaaS, On-premises)	Licensing Model (Perpetual, Subscription, Usage)	Version
Collaboration Software						
File storage and sharing	Allows users to store files, synchronize files across devices, and share files (e.g. Google Drive, One Drive)					
Instant messaging, video chat	Allows conversations between two or more users, usually the service can be accessed online through or through mobile apps (e.g. Skype, Google Hangouts)					
Tele-conferencing	Software used for delivering, tracking and managing training and education. It tracks data about attendance, time on task, and student progress. Educators can post announcements, grade assignments, check on course activity, and participate in class discussions. Students can submit their work, read and respond to discussion questions, and take quizzes. (e.g. Moodle, Canvas)					
Video streaming	Allows video sharing (e.g. Youtube, TeacherTube)					
Email	Electronic Mail (e.g. GMail, Outlook)					
Calendaring	Software that provides students with an electronic version of a calendar. Additionally, the software may provide an appointment book, address book, and/or contact list (e.g. Outlook, Google Calendar)					

Educational Software (continued)

Software Type	Description	Software used by the school (include version)	Manufacturer	Delivery Model (SaaS, PaaS, On-premises)	Licensing Model (Perpetual, Subscription, Usage)	Version
Content Management						
Wiki and Web page creation	Allows publishing original content online in the form of Wikis or Web sites. The process includes building and uploading websites, updating the associated webpages, and posting content to these webpages (e.g. Google sites, Wix)					
Blog publishing	Allows multi-user blogs with time-stamped entries. (e.g. Blogger, Tumblr, Ghost)					
Learning Management						
Learning Management System	Software used for delivering, tracking and managing training and education. It tracks data about attendance, time on task, and student progress. Educators can post announcements, grade assignments, check on course activity, and participate in class discussions. Students can submit their work, read and respond to discussion questions, and take quizzes. (e.g. Moodle, Canvas)					
Studing Information System (SIS). Also known as student management system, school administration software or student administration system	Is a management information system for education establishments to manage student data. Student information systems provide capabilities for registering students in courses; documenting grading, transcripts, results of student tests and other assessment scores; building student schedules; tracking student attendance; and managing many other student-related data needs in a school. (e.g. Sawyer, Alma)					
Virtual Classroom						
Virtual classroom software	Enables teachers to instruct live on the web and also present live classes in addition to online lessons. The most common features are; screen sharing, interactive whiteboard, instant messaging for teachers and students chat with each other instantly, teachers can record and save the whole class, so that the absent students can review it after class. (e.g. ezTalks Meetings, Adobe Connect, Blackboard Collaborate)					

Educational Software (continued)

Software Type	Description	Software used by the school (include version)	Manufacturer	Delivery Model (SaaS, PaaS, On-premises)	Licensing Model (Perpetual, Subscription, Usage)	Version
Assistive Technology for students with disabilities (Software)						
Text To Spech (TTS) Software	Software designed to help children who have difficulties reading standard print. Common print disabilities can include blindness, dyslexia or any type of visual impairment, learning disability or other physical condition that impedes the ability to read					
Screen readers	Screen readers allow the visually impaired to easily access electronic information. These software programs connect to a computer to read the text displayed out loud.					
Proofreading software	Proofreading software is a branch of assistive technology that goes above and beyond the typical proofreading features found in a word processing system, such as correcting words frequently misspelled by students with dyslexia. A number of other features offered within this category can help students work on his or her English skill set to become a more effective and accurate writer					
Speech-recognition software	A speech recognition program works in conjunction with a word processor. The user "dictates" into a microphone, and his spoken words appear on the computer screen as text. This can help a user whose oral language ability is better than his writing skills					
Talking calculators	A talking calculator has a built-in speech synthesizer that reads aloud each number, symbol, or operation key a user presses; it also vocalizes the answer to the problem. This auditory feedback may help him check the accuracy of the keys he presses and verify the answer before he transfers it to paper					

Educational Software (continued)

Software Type	Description	Software used by the school (include version)	Manufacturer	Delivery Model (SaaS, PaaS, On-premises)	Licensing Model (Perpetual, Subscription, Usage)	Version
Information Security						
Authentication and Access Control	Allows users authentication and restriction of access to a place or resource					
Antivirus software	Antivirus or anti-virus software, sometimes known as anti-malware software, is computer software used to prevent, detect and remove malicious software					
Anty-spyware	Software dedicated to remove or block spyware					
Firewall	A firewall is a software program or piece of hardware that helps screen out hackers, viruses, and worms that try to reach your computer over the Internet					
Intrusion detection system	An intrusion detection system is a device or software application that monitors a network or systems for malicious activity or policy violations					
Content-control software	Software designed to restrict or control the content a reader is authorised to access, especially when utilised to restrict material delivered over the Internet via the Web, e-mail, or other means. Content-control software determines what content will be available or be blocked					

Educational Hardware

Hardware Type	Description	Hardware used by the school (include model)	Manufacturer	Is a second-life?	Operating System
Personal Devices					
Laptop/Notebook					
Tablet					
Desktop computer					
Devices in classroom					
Interactive whiteboard	A large interactive display in the form factor of a whiteboard. It can either be a standalone touchscreen computer used independently to perform tasks and operations, or a connectable apparatus used as a touchpad to control computers from a projector.				
Digital camera					
Video game console					
Video projector					

Educational Hardware (Continued)

Hardware Type	Description	Hardware used by the school (include model)	Manufacturer	Is a second-life?	Operating System
Assistive Technology Devices					
Assistive Listening Systems	A variety of assistive listening systems, or hearing assistive technology, can help students who are deaf or hard of hearing, as well as those with other auditory and learning problems				
Sound-Field Systems	These devices assist listening for all children in the class. These systems benefit not only children that have hearing loss, but those that have other auditory and learning problems, such as language delays, central auditory processing disorder, articulation disorders and development delays. Additionally, sound-field systems can be used for students who are learning English as a second language.				
Sip-and-Puff Systems	Sip-and-puff systems are used by students who have mobility challenges, such as paralysis and fine motor skill disabilities. These systems allow for control of a computer, mobile device or some other technological application by the child moving the device with his or her mouth. Similar to a joystick, the child can move the controller in any direction and click on various navigational tools using either a sip or a puff. An on-screen keyboard allows the child to type using the same movements.				

Google Form

The questions that were used in the Google form are shown below, divided into sections.

Team Member Identification
Your Name
School Interview Information
Town
School Name
Primary Interviewee
Additional Interviewee
Position/Title of Primary Interviewee
Grade Level of School Interview Pertained to (select all applicable if you discussed more than one school)
Number of Students
When was the school's building/technology project completed?
Budget Information
Approximate Annual Budget for District
Approximate Budget for Technology Only
Approximate Annual Budget for Maintenance
Education Hardware for Teachers
Primary device used by TEACHER in the classroom
In addition to the Primary device above, are there any ADDITIONAL devices the TEACHERS use in the classroom? (check all that apply)
Do TEACHERS take their devices home?
Educational Hardware for Students - Y/N Pivot Questions to Other Sections
Do any students use a DESKTOP computer as their PRIMARY device in the classroom?
Do any students use a Laptop or Notebook as their PRIMARY device in the classroom?
Do any students use a Tablet as their primary device in the classroom?
Educational Hardware - Students - Desktops
Are desktops purchased or leased as part of a service agreement?
What Operating System (OS) type do the DESKTOP COMPUTERS run in the classroom?
Please list the vendor or purchasing channel (if known) for DESKTOP COMPUTERS?

Please list the grade levels of classrooms/students that use DESKTOP COMPUTERS in the classroom
What is the device:student ratio of DESKTOP COMPUTERS?
What Manufacturer & Model DESKTOP COMPUTERS are used, if known?
Replacement Cycle: Method of Replacement for DESKTOP Units
Replacement Cycle: Replacement Interval for DESKTOP Units
Any additional comments about the replacement cycle?
Any additional comments about DESKTOP computers used in the classroom?
Educational Hardware - Students - Laptops/Notebooks
Are laptops/notebooks purchased or leased as part of a service agreement?
Please list the vendor or purchasing channel (if known) for NOTEBOOKS/LAPTOPS?
What Operating System (OS) type do the LAPTOP COMPUTERS run in the classroom?
What Manufacturer & Model LAPTOP / NOTEBOOK COMPUTERS are used, if known?
Please list the grade levels of classrooms/students that use LAPTOP / NOTEBOOK COMPUTERS in the classroom
What is the device:student ratio of LAPTOP / NOTEBOOK COMPUTERS?
Do students take their LAPTOP/NOTEBOOK computers home?
How are LAPTOP/NOTEBOOK computers charged in the school?
Replacement Cycle: Method of Replacement for LAPTOP / NOTEBOOK Units
Replacement Cycle: Replacement Interval for LAPTOP / NOTEBOOK Units
Any additional comments about the replacement cycle?
Any additional comments about LAPTOP / NOTEBOOK computers used in the classroom?
Educational Hardware - Students - Tablets
Are tablets purchased or leased as part of a service agreement?
Please list the vendor or purchasing channel (if known) for TABLETS?
Which type of tablet is used?
What is the screen size for TABLETS used?
What Manufacturer & Model TABLETS are used, if known?
Please list the grade levels of classrooms/students that use TABLETS in the classroom
What is the device:student ratio of TABLETS?
Do students take their TABLET units home?
How are TABLETS charged in the school?
Replacement Cycle: Method of Replacement for TABLET Units

Replacement Cycle: Replacement Interval for TABLET Units
Any additional comments about the replacement cycle?
Any additional comments about TABLET computers used in the classroom?
Internet Connections
Do all classrooms have Wi-fi available for students?
How many wireless access points are in the school?
Are there wired connections available in the classroom in addition to the Wi-Fi?
What type of internet connection does the school primarily use?
Was any additional information about the primary internet connection, such as ISP, speed, or bandwidth available? Please describe if so.
Interactive Boards/Smart TV (Section is skipped if "No" selected for first question)
Does the classroom use interactive whiteboards or interactive projectors?
Which type of device is PRIMARILY used in the classroom for interactive lessons?
In addition to the PRIMARY device, what other types are used?
Does the unit function as a stand-alone device, or is it paired with a computer in the classroom?
Can students use the device to share or project from their own computers?
If known, what is the Manufacturer and Model of the interactive device(s)?
How many classrooms use these interactive devices?
Do you have any additional comments or information on the interactive devices?
General Classroom Technology
How many standard (2D) printers are in the school
How many 3-D printers are in the school
How many standard (2-D) scanners are in the school
How many 3-D scanners are in the school?
Please check off all of the following devices that are in the classrooms.
Please give any manufacturer, model, or other specific information you gathered on the devices from the previous question
Assistive Technology - Hardware
Are Assistive Listening Systems employed?
Are Sound-Field Systems employed?
Are Sip-and-Puff systems available?
Please list any additional Assistive Technology (Hardware) that is used in the classroom
Software: Office/Productivity

What type of software is used for WORD PROCESSING?
What type of software is used for SPREADSHEETS?
What type of software is used for PRESENTATIONS
What type of Software is used for NOTE-TAKING?
Software: Collaboration
What type of software is used for File Storage / Sharing
What type of software is used for instant messaging, video chat, etc
What type of software is used for video streaming/sharing?
What e-mail client is used?
What software is used for calendar/scheduling
Software: Content Management
What type of software is used for Wiki / web page creation
What type of software is used for blog publishing?
Software: Learning Management and Virtual Classroom
What type of software is used for lesson plans, lesson content, learning/lesson management and electronic assignment submission (check all that apply)
If known, what type of software is used for SIS (Student Information System) for student attendance, registration, grading, transcripts, etc?
Does the school use Virtual Classroom or Distance Learning technology?
If the school uses Virtual Classroom or Distance Learning Technology, please list the software they use (Skip if not used)
Assistive Technology - Software
Is Text-to-Speech (TTS) software used?
If TTS software is used, what software do they use? (leave blank if not used)
Are Screen Readers used?
Is assistive Proofreading software, beyond a typical spelling/grammar check, used?
If assistive Proofreading software is used, what software do they use? (leave blank if not used)
Is Speech Recognition Software used?
If Speech Recognition software is used, what software do they use? (leave blank if not used)
Are Talking Calculators Used?
Information Security
What service is used for primary account authentication and access control?
If known, what software is primarily used for Antivirus protection?

If known, what software is primarily used for Anti-spyware protection?		
If known, what firewall software is used?		
If known, what intrusion-detection software is used?		
If known what content-control or filtering software is used?		
If known, how is Wi-Fi Access controlled? (check all that apply)		
IT Services, Contractors, and Responsibility		
How does the school handle IT services?		
How many in-house IT staff are there?		
If any IT Services are contracted, which vendors are used?		
If any IT additional services are contracted, please list them		
If Contract services are provided, how is the cost assessed?		
If known, what is the contract cost per unit given in the last question?		
Is the school happy with their IT contract service?		
Please check off the responsibilities per in-house IT staff and contract IT staff (as much as you know) for following areas:		
Area of Responsibility	**Inhouse IT Staff**	**Contract IT Staff**
[Account Creation/Maintenance]		
[Network traffic filtering/monitoring]		
[Antivirus management]		
[Virus removal]		
[Help Desk/General Support]		
[Software installation/distribution/licensing]		
[Hardware and device support/repair]		
[Web-based portal(s) and access]		