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Student perceptions on the innovative use of technology in Iowa classrooms

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STUDENT PERCEPTIONS ON THE INNOVATIVE
USE OF TECHNOLOGY IN IOWA CLASSROOMS

A Thesis Submitted
in Partial Fulfilment
of the Requirements for the Designation
University Honors

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This Study by: Preston Henry Vorthmann

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Date

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Introduction

According to information from AEA 267 and the Annual Report on the Condition of Education 2016 by Iowa's Department of Education (IDOE), 198 school districts out of 336 in Iowa (about 58%) have implemented a form of 1:1 programs, giving their students access to a tablet or laptop computer. This trend in education falls in line with the increased technology expenditures observed by the state in the past 10 years (Figure 1). These expenditures also relate to increased spending per pupil, which further supports that this increase is due primarily to the adoption of 1:1 and not, for example, a rapid increase in students (Figure 2).

This large investment in technology, \$73.9 million dollars in the last year alone (IDOE, 2016), has the possibility of not being fully utilized. If technology is being used predominantly as a replacement for conventional methods, a digital form of analogue practices, then school districts are not fully implementing the technology to its fullest potential. The broader purpose of schools adoption of 1:1 is to allow educators to do things they could not before. So, using technology in innovative, new ways would be a school districts best use of the technology or how these educators can get the most out of their investment.

An evaluation of how technology is being implemented in classrooms would benefit school districts that have already made the adoption of 1:1 programs, showing possible gaps in professional development and implementation strategies if used predominantly for conventional means. An evaluation would also benefit school districts looking to make an investment in 1:1 programs, because it could show possible avenues towards innovative uses of technology that do not require 1:1 adoption. Such an approach could save school districts from the high costs associated with a 1:1 investment, but still help them achieve innovative uses of the technology that has been already purchased by the district. So rather than making the high investment in a 1:1 program, this evaluation could show how school districts who might already have technology

in the classroom, such as projectors, can still reach innovative uses with that technology. This would predominantly help school districts with less money, who cannot afford a 1:1 program, but still want to have good technology implementation.

While the Iowa Department of Education does not provide any evaluation of technology implementation for school districts, this thesis aims to provide one. To do this, college students were asked about their perceptions of innovativeness of their high school teachers' use of technology in the classroom. An online survey of college students taking Inquiry into Life Sciences, Earth and Space Science, and Physical Science at the University of Northern Iowa was given to record these perceptions, during the Spring Semester 2017.

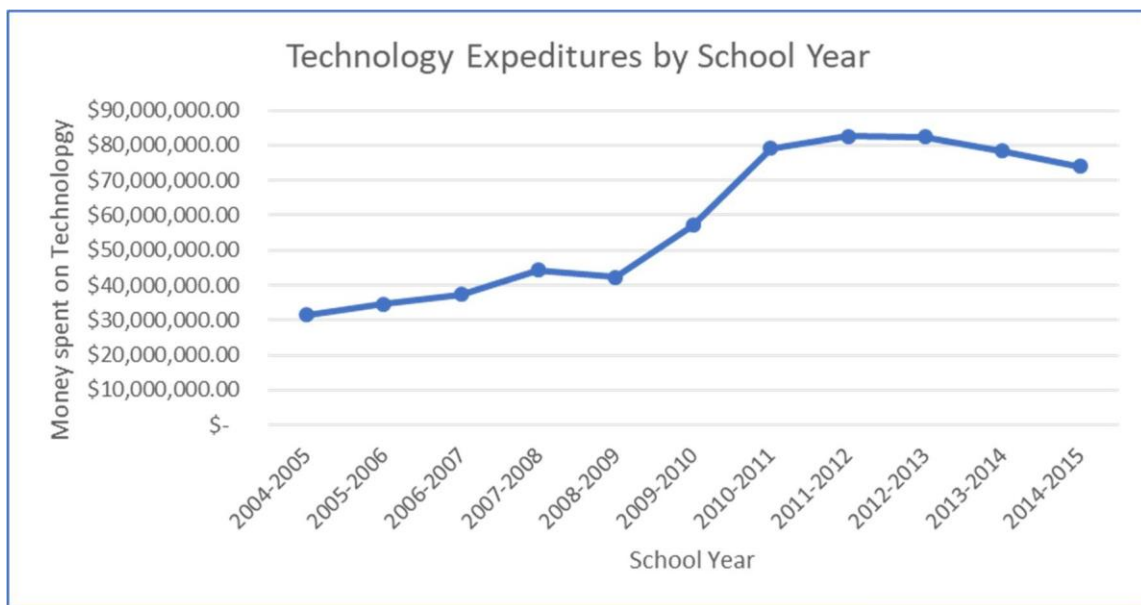


Figure 1 (IDOE, 2016)

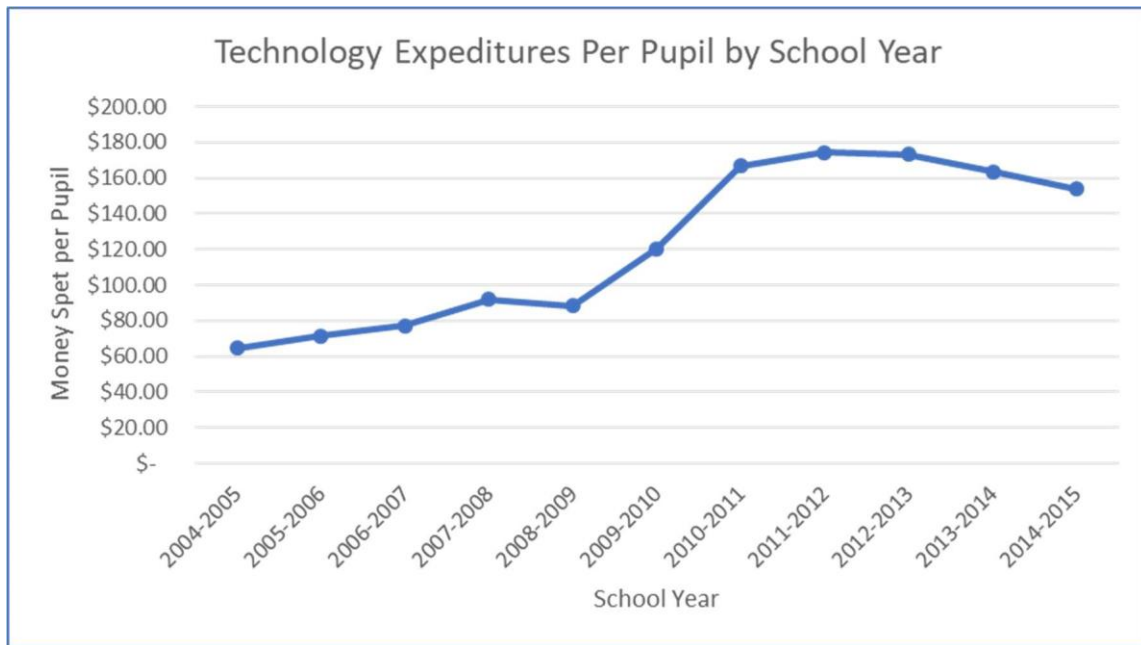


Figure 2 (IDOE, 2016)

Definitions

These definitions were created to better analyze the data and help categorize survey responses.

1:1 Program: a program where each student in a given grade level(s) is given by the form of technology by the school for use in the classroom. Sometimes it can be used at home as well.

Bring Your Own Device (BYOD): a technology implementation chosen by some schools where students and staff provide the technology used in education, rather than being supplied by the school itself.

Conventional Means: this refers to a paper and pen solution. For example, paper worksheets, paper tests, have students develop posters, etc. Also, referred to as analogue forms.

Innovation: activities with technology that do not involve tasks that can be done in a more conventional method (pencil and paper). Examples of non-innovative uses would be

multiple choice tests, word documents, etc. Examples of innovative uses would be collaborative blogs, wikis, podcasts, etc.

Literature Review

Technology has become ever present in Iowa schools. The ratio of students to computers in Iowa has increased, from 4:1 students per computer in the 2000-2001 school year to 1:1 students per computer in the 2015-2016 school year (IDOE, 2016). This is largely due to the adoption of 1:1 programs (Figure 3), where each student in a given grade level receives a computing device (laptop, tablet, etc.) to use at school and possibly home. While not all school districts have 1:1 programs, a possible reason for the Department of Education's number being 1 computer per student, would be a double counting of a school's various technology solutions. For example, a school district with a 1:1 program might also have a computer lab still in use as well as a mobile cart system. This would make that school's average student to computer ratio less than 1:1, because there would be more computers available for student use counted for that school (the 1:1 computes plus the computer lab and mobile cart system). This might help explain, that while not all school districts have adopted 1:1 programs, the multiple counting of all a school's student

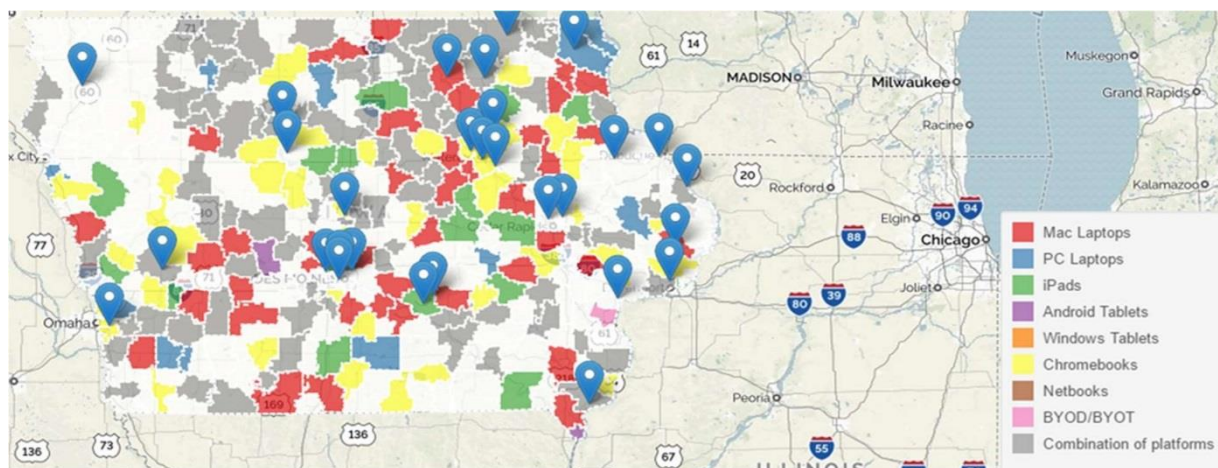


Figure 3 (1:1, 2005)

technology solutions has brought the state average down to 1:1 student per computer. Schools that implement 1:1 programs have been seen to improve communication skills (Gravelle, 2003), cognitive performance (Quinn & Valentine, 2001), literacy skills (Warshauer, 2009), and have many other benefits. These perceived benefits are what has driven the adoption of 1:1 across Iowa. However, once technology is purchased, it is generally the responsibility of the school to build and maintain an infrastructure to support it, as well as the teacher to implement it, to gain those benefits (McAdoo, 2005).

A key part of implementing technology into the classroom is to incorporate it into daily activities but also to shift the focus of the class. To be successful in implementation, the instructor must transition from teacher-centered learning, a top down instruction model, to a more student-centered approach (Donovan, Hartley & Struder, 2007). In being student-centered, the level of integration of technology into the curriculum is determined by the student. This allows students the ability to think of innovative uses that, in a teacher-centered model, may not have been thought of. Here the teacher moves from a leader to a guide, helping students in the learning process and providing a strong framework on which they can build and innovate (Yang, 2002). Yet, not all teachers have joined technology with the curriculum, as needed to be successful. A study by the Washington Post of Maryland schools observed teachers and students using computers for basic tasks, such as word processing and email communication (Mui & Partlow, 2005). Another study commented on the frequency of reluctance to implement technology in a meaningful way in the classroom (Lee, 2006). This could be due to several factors such as a teacher's discomfort with technology, lack of professional development on the subject, or poor overall school infrastructure to support learning environments.

However, truly innovative learning with technology can occur when it is embraced, shifting to the student-centered model, focusing on collaboration and communication, and providing the training and infrastructure to support it (Yang, 2002). Rather than just teaching a student a static skill, they can be taught how to use the tools and technology they have, to solve a problem on their own (Boardman, 2012). For example, instead of just teaching students how to use a printer to print a paper for markup, a teacher would guide students in finding out how use a printer on their own, or encourage using other methods for marking up a paper electronically that could offer different insights and collaboration than what those marking up a paper copy would provide. Another example would be Ben Sanoff's World History class in Berkeley, California that has a class blog, allowing for class discussions to continue outside of the classroom. Another class in College Park, Georgia runs a wiki about a student-created historical novel that has received traffic from around the world (Walser, 2011). These last two examples show innovative uses of technology in the classroom. Teachers are not just teaching how to type on a keyboard, or create a simple word document. They are incorporating tools, like wiki and blogs, tying in the curriculum into a compelling, student-centered format that promotes collaboration, engagement, and communication amongst students. Using technology innovatively is truly the best use for the money being spent, because it provides a new way to teach students in a way that before was not available. To understand if Iowa is using technology innovatively, we must first understand what technology is in classrooms and how it is being implemented day-to-day.

Research Question to be Answered

1. What types of technology are observed in Iowa schools?
2. What levels of integration of technology are observed in Iowa schools? (Table 1)

3. For the integration deemed innovative, how can those examples be communicated and incorporated amongst a range of different curriculum?

Methodology

School districts have spent millions of dollars (\$73.9 in the 2015-2016 school year alone) on technology expenditures. These have been predominantly due to the adoption and upkeep of 1:1 programs, where every student receives a computer or tablet from the district. However, there is very little to no information about how this technology is being implemented in the classroom after it has been purchased and distributed to students and educators. Is this technology being used for conventional purposes or in innovative ways? Only the latter use would be where the technology is allowing educators to teach in ways they could not before, where districts and taxpayers alike are getting the most for their investment in this technology.

To shed some light on this implementation an online survey was distributed.

The first part of the survey consisted of establishing the level of technology in that participant's school. Some examples from the survey would be asking about the specific technology policy of the school (1:1 or BYOD), what type of technology was available, if internet across campus was present, etc. The second half of the survey consisted of gauging the use and implementation of this technology. Was it used primarily in innovative ways? Was it used to replace conventional methods? Was it possibly not integrated at all into the curriculum? The 15-question survey was submitted and approved by the IRB in early March and was administered online through Survey Monkey. It was offered to University of Northern Iowa students enrolled in Inquiry into Life Science, Earth and Space Science, and Physical Science in March of the Spring Semester 2017. These classes have about 100-300 students in them. The

classes were selected based on having students that were generally younger, with the intent that their memories of high school would be fresher and more relevant. Another reason for using these classes was their professors' willingness to help. As per IRB approval, the professors were first sent a scripted email asking for their help. They were then asked to forward an email to their students. The email forwarded was also scripted and contained the informed consent for the survey, as well as the link for students seeking to respond. There was no incentive given for taking this survey.

From the population of about 100-300 students, the sample consisted of 22 responses. Of the 22, a group of 15 fully completed the survey because they answered yes to having some form of student computers (Appendices B3). Within that group of 15, 9 respondents answered the section of "Innovativeness with 1:1" and 5 answered the section of "Innovativeness without 1:1" with one person skipping that section. These two groups were later compared against each other. Table 1 was used for one question (Appendices D5, E5) to determine the level of integration differences observed between the two groups.

Measure of Level of Integration of Technology in the Classroom				
1 Poorest Integration	2 Poor Integration	3 Fair Integration	4 Teacher Centered Integration	5 Student Centered Integration
No technology use by both teacher and students.	Only teacher uses technology in the classroom.	Teacher and students both use technology in the classroom, but not all the time. Might take a test on laptops, but then not use them for the rest of or until the next unit.	Teacher and students use technology as a complete replacement for conventional means, though the format in assignments and assessment is the same as in paper form.	Teacher and students use technology in innovative ways, integrating it seamlessly into the curriculum.

Table 1

Results

Getting to Know You

The first part of the survey aimed at getting some demographic information about the people taking the survey. Most respondents fell in the age range of 19-21 (91%). About 90% of respondents had as their major elementary education and they were mainly second and third year students. All respondent attended an Iowa public high school with wireless internet access (See Appendix A).

Technology Observed

This leads into the second part of the survey about technology observed in the classroom. All respondents observed teacher computers, 91% were in a classroom with a projector, and 60% with a smartboard. Looking at cell phones, 60% observed their use in the classroom, while only

32% observed student computers. When asked if computers were allowed to be used by students in the classroom, 68% responded yes, and 32% responded no (See Appendix B)

Student Computer Information

The next part of the survey was only asked to the 15 students (68%) that had observed computer use by students in the classroom. The questions in this part of the survey were intended to get information on the type of technology being used. The top three operating systems observed were Microsoft Windows at 40%, Apple OSX at 33%, and Google Chrome OS at 33%. Computer integration observed in schools consisted mainly of 1:1 at 40%, computer lab at 40%, mobile cart system at 33%, and a combination of 1:1 and BYOD at 20%. Some respondents observed multiple types of integration, for example identifying their high school as having both a computer lab and mobile cart system. (See Appendix C)

Innovation with 1:1

The last two parts of the survey asked the same questions but to different subsets of respondents. These questions tried to get information on innovative uses with technology observed by the respondents. The 9 respondents who observed 1:1, BYOD, or a combination of both 1:1 and BYOD went to the “Innovation with 1:1” part of the survey. The 5 respondents who answered only computer lab, mobile cart system, or other went to “Innovation without 1:1”. Looking at the answers from “Innovation with 1:1”, 89% observed innovative uses of technology by their teachers. In using technology for conventional means, 67% observed this in their classroom, with 22% using technology for conventional means sometimes. All the respondents in this part of the survey said they had used technology for something they could have done on paper, while 78% had also done something in the classroom that required technology. The

majority of those with a form of 1:1 observed computers integrated mainly for conventional means, at 56%. Mobile technology integration was a mix at about 22% in every category except 1, and 44% observed projectors and other display technologies used in innovative ways. Lastly, 67% said having computers were beneficial to their academic career. (See Appendix D)

Innovation without 1:1

Now looking at respondents that had student computer access but not in the form of 1:1 or BYOD, 80% observed innovative uses of technology in the classroom. None of these respondents observed using technology for conventional means all the time, with 40% not observing it and 60% observing it only sometimes, depending on the teacher. Interestingly, 80% of respondents observed using a computer for something that could have been done on paper, with a 50/50 split in having an experience that could not have occurred without technology. In computer integration, the majority, at 60%, observed that both teacher and student used technology, but for conventional means. In mobile integration, 80% observed both teacher and students used that technology, but infrequently. In projectors and other display technology, 40% said it was used infrequently and 40% said it was used in new, interesting ways. Finally, 60% said student computers benefited them in their education, even without having a personal 1:1 computer or a BYOD policy in their school. (See Appendix E)

Discussion

Demographics

The majority of respondents were in the 19 -21 age range, which was expected for those in the classes surveyed. This was beneficial, because it allowed for more recent experiences of high school to be shared in the responses, rather than ones possibly before the move towards 1:1

that began around 2005 (AEA, 267). The respondents also all attended an Iowa public high school and observed wireless internet across their campus (Appendices A4, B1), giving this research a good foundation in comparing responses, as they all have a similar background.

Types of Technology Observed

The study's first research question investigated the type of technology observed in Iowa schools. In answering this research question, Figure 4 (based on Appendices B2) most clearly shows the types of technology observed. Not surprisingly all teachers were observed to have computers. Projectors and smartboards were also fairly common, at 91% and 60% respectively. These display technologies play a crucial role in innovative uses, as will be discussed later. Figure 4 also shows two very interesting results, that I believe to be related to some of the limitations of survey. Only 32% of respondents observed student computers in the classroom, which is contradictory to a later question where 68% observed student computers. Respondents might have been confused about what the term computer was meant to convey, with Appendices C1 expanding on the definition of computer types considered a computer in this survey. In light of Iowa Core adoption and 21st Century Skills implementation, this number should have been 100%. The 21st Century Skills, which are part of the Iowa Core, dictate that technology literacy should be incorporated into curriculum across content areas (Technology Literacy). The lack of integration could be due to several things, possibly including lack of professional development or discomfort with technology. The other result was that 60% of respondents observed cell phones in the classroom. Again, I think a limitation is observed. This question aimed to look at technology used for educational purposes in classroom, though the "for educational uses" was not clearly directed in the survey question. Looking at any high school classroom, the amount of

cell phone usage is high, though not predominantly used for educational purposes but rather for socializing, which might explain the high rate observed for cell phones in Figure 4.

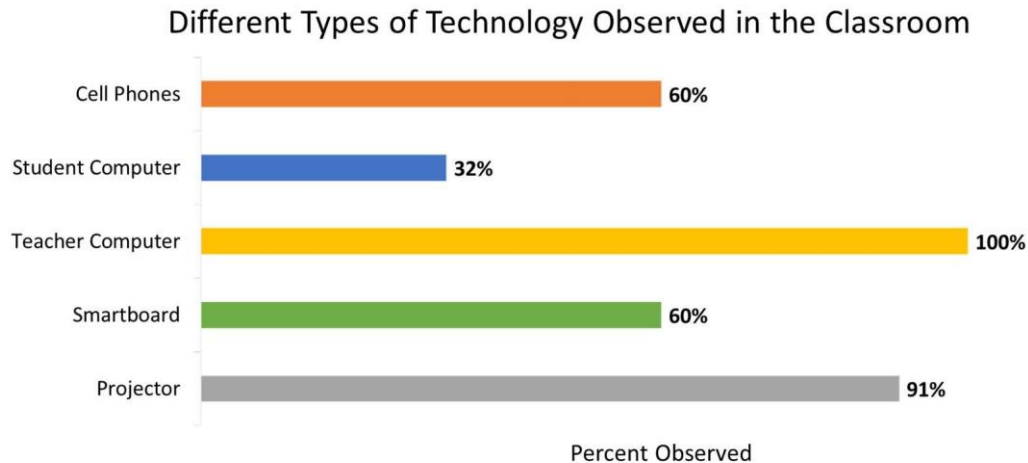


Figure 4

In terms of the operating systems observed in the classroom, from that 68%, it is surprising that Windows is the majority at 40% (Appendices C1). Looking back at Figure 3, Windows has a very small slice of the Iowa education market, with Apple (Mac computers and iPads) looking to be the dominant player, and Google's Chromebook platform as a close second. This would suggest that the respondents do not represent the state population, which could be explained by the small sample size. However, Appendices C1 does show the close race between Apple's and Google's products, which helps lend some credibility to the responses. Another factor to consider is how Figure 3 displays its information. The map shows what type of operating system a school district with 1:1 has. It does not show all the operating systems available to the students. For example, if a school adopted Chromebooks as its 1:1 solution, Figure 3 would show that. The school might also have a couple of computer labs with Windows computers, which would not be shown in Figure 3. The prevalence of other operating systems in

a school district available to students in addition to 1:1 might help explain why Windows was observed so highly by our respondents, but is not prevalent on Figure 3's map of 1:1 programs.

Level of Integration of Technology Observed in Iowa Classrooms

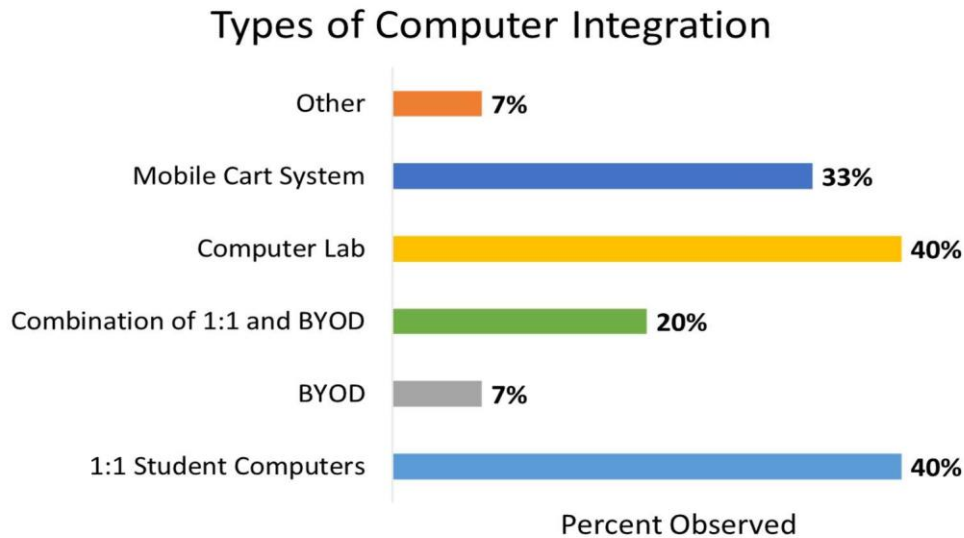


Figure 5

Figure 5 shows the breakdown of the form of integration of the computers used in the classroom. The integration consists of two general camps. One is where students have a personal computer assigned to them (1:1, BYOD, or combination of the two). The other is a computer the school provides, but is not personal to that student (computer lab, mobile cart system, and other). The total percent of respondent in the 1:1 camp is about 67%, which a bit higher than the state average, 58%. This could be due to the location of respondents (with the University of Northern Iowa possibly containing fewer students from the Northwest/Southwest due to distance, where there are fewer schools with 1:1 according to the Figure 3 AEA 267 map) and the small number of responses.

Integration Deemed Innovative

The last research question looked for examples of innovative integrations of technology that could be incorporated amongst different curriculum. Comparing the two groups in their

responses to innovativeness observed, both groups largely observed teachers using technology to educate in a way not possible before, such as a class wiki (Appendices D1, E1). It might be surprising that the group without 1:1 was also high in observing innovative uses of technology, at 80%. A possible explanation is that since their teacher allows students to use computers in class and are required to implement some form of technology literacy per Iowa Common Core, that part of the integration would be an activity that requires technology, even though without 1:1 it becomes less accessible to do so. The group with 1:1 also observed teachers using computers for more conventional purposes when compared to the students without 1:1. This could be possibly due to convenience, since knowing all students have a personal computer allows the teacher to better replace conventional methods to try and save resources or time. An example would be giving a multiple-choice test on the computers as compared to paper. The benefit for the teacher would be quick grading when the students submit the test electronically, as compared to hand-grading tests. There was an increased rate in new experiences that required technology by the student in the 1:1 group, 78%, as compared to the group without 1:1, 50% (Appendices D4, E4). This is possibly explained again that if students have a personal computer, the teacher can reliably plan instruction around integrating computers, leading to their increased use in innovative ways.

Figures 6 and 7 show the most interesting results of the survey. While both groups (looking just at computer integration in grey) mainly observed both the teacher and student using technology for conventional means, only the group with 1:1 observed both teachers and student using technology in new, interesting ways. That answer (Both use technology in new and interesting ways) was used to measure the total level on innovativeness in the classroom, for both

the teacher and student. The possible answers to this question came from Table 1, with this question meant to have respondents place their schools along Table 1's continuum of integration. It is significant that of the two groups, only the group with 1:1 observed innovation for both teacher and student in computer integration. Given that the teacher can rely on the fact that students have their own personal computer, new activities can be incorporated into the curriculum that were not otherwise possible, which is an efficient use of the resources available. Focusing on the display technology integration (projectors, smartboards, etc.) of Figure 6 and 7, both students with 1:1 and without observed display technologies being using innovatively. The prevalence of these display technologies (Figure 5), might allow school districts lacking funds to hold off on adopting 1:1 to save money, but still attain an innovative use of technology in their schools.

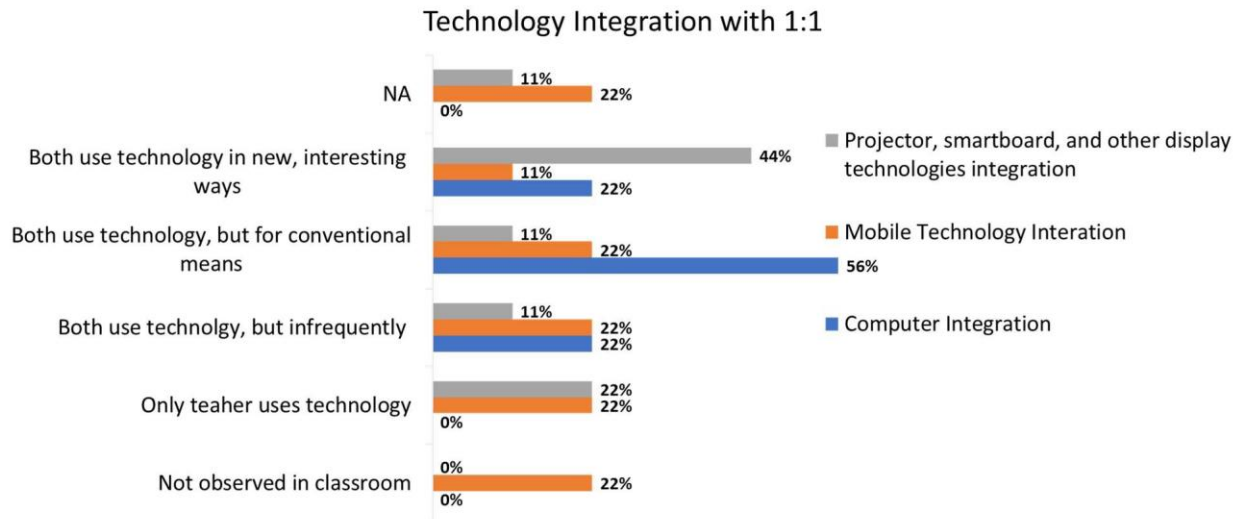


Figure 7

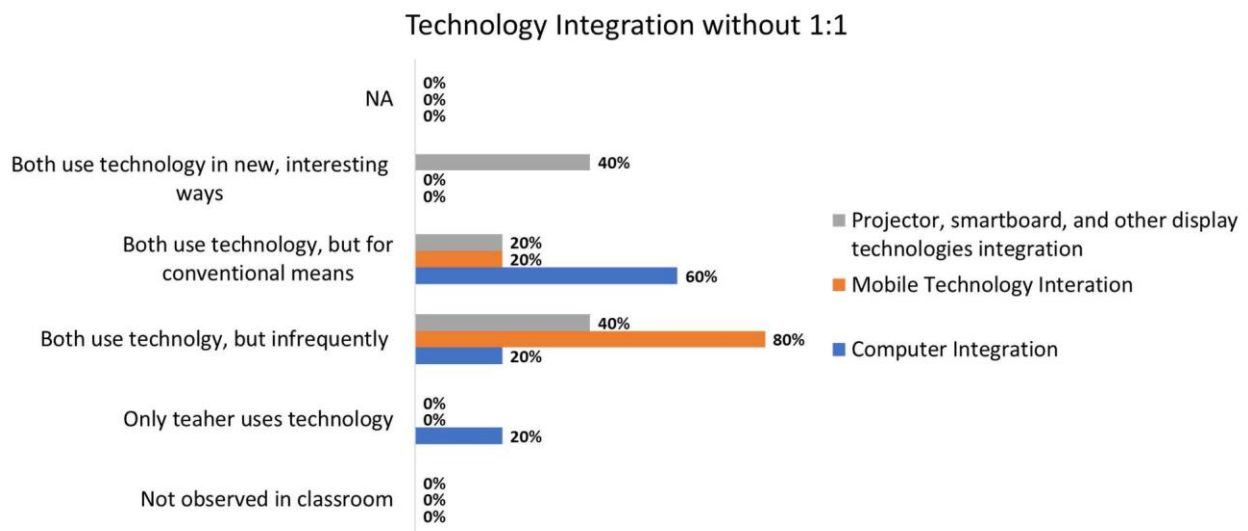


Figure 7

Limitations

The research questions, “What types of technology are seen in Iowa schools?” and “What level of integration of technology is seen in Iowa schools?” remain only partially answered. With such a small number of respondents, there is no clear picture of technology and its integration in Iowa schools. The responses do show some trends of the types of technology seen in Iowa schools that do relate to other sources, like AEA 267 map of 1:1 operating systems (Figure 3).

The third research question this thesis aimed to answer, “For the integration deemed innovative, how can those examples be communicated and incorporated amongst a range of different curriculum?” was not answered at all. While innovativeness was evaluated in the survey, no examples of innovative uses were generated by respondents. My guess as to why would be the structure of the survey. The questions asked in Appendices D1 and E1 were intended to answer that research question. In the survey given, the response for those questions were set to short answer format, meant to convey more detail than a yes or no answer (previously in the survey, questions looking for a yes or no answer had multiple choice for response options). However, without the possible instructions within the question of “Explain” or “Give an example” no examples were collected.

In regard to mobile integration questions, it was not clearly illustrated that these questions referred to educational uses of that mobile technology. If questions had been clearer, the responses might have helped school districts looking to have an implementation where every student had a personal computing device, but not provided by the school district. For example, if a school district needed to save money or didn’t have the funds to make a 1:1 purchase, allowing a BYOD policy, which would include mobile technology, might be an avenue towards every student having a personal computing device. This would allow teachers to use that technology more innovatively, because they could rely on its presence, and better meet the Technology Literacy Standards in the Iowa Common Core. However, because of the lack of clarity in the questions, the responses do not show if allowing mobile technology into the classroom would be more of a benefit or distraction. Thus, it would not allow school districts making technology purchase decisions to use this data in any meaningful way.

Recommendations for Future Research

The third research question was not answered at all by the survey. This could be a very interesting to answer, because given a variety of good examples of innovation, these could help teachers struggling with implementing technology in new and interesting (innovative) ways that lead to a more student-centered classroom.

Another path of research could be why some teachers do not allow students to use computers in the classroom. In the survey, 32% responded that computers for students were not allowed (Appendices B3). If research could identify the culprit(s) that prevent teachers from integrating technology into the classroom with students, school districts could use that information to better prepare their teachers. If the culprits were to be addressed, then all teachers would be capable of implementing Technology Literacy as part of 21st Century Skills and Iowa Common Core, something all content areas should be pursuing.

A final area of investigation is which operating system, Microsoft Windows, Apple OSX/iOS, or Google Chrome OS/Android, is the best for an educational setting. One of the comments to the last question of the survey (Appendices D6) from a respondent who had 1:1 said they found having a personal computer to be distracting and not beneficial to their academic career. Would a different operating system have been less distracting or more productive for that respondent? Appendices C1 shows that Microsoft, Apple, and Google are fairly even in their competition for the classroom observed by the respondents. This is also supported in AEA 267's map of 1:1 adoption in Iowa (Figure 3). The education market, a subset of the enterprise, is seen as crucial by all three of these companies. If they can get students comfortable with their computing solutions early on, their preference of operating system will follow them into the workplace or enterprise market as a whole. Microsoft is even positioning a new version of their

Windows operating system, called Windows Cloud, to compete with Chromebooks in the education space (Thurrott, Foley, 2017). It would be interesting if research was done as to which platform provided the best experience for the student, something that could help school districts when making technology expenditures in the future, for 1:1 adoption and upkeep.

Conclusion

This research attempted to record the level of innovation and integration of technology observed in Iowa classrooms. If innovation was observed highly, then the money being invested in technology, especially 1:1 programs, would have been used efficiently, allowing for educators to teach in new ways not possible before the technology purchase. If technology was observed to be used for more conventional means, then school districts across Iowa would need to address the lack of innovative uses, using tools like professional development and other training opportunities to prepare teachers and get the most out of their technology purchases.

Key findings of this research were the predominant use of technology for conventional purposes by school districts with 1:1, that only schools with 1:1 were observed to have innovative uses of computer integration, and that display technology can be used for innovative purposes regardless of 1:1 adoption or not. The fact that school districts with 1:1 use the technology mainly for conventional means (Figure 6) would suggest that school districts are not getting all they can from their technology purchases. This might also suggest a need for increased or better professional development to help all educators reach innovative uses of technology. This would help teachers meet both the state standards for Technology Literacy and get the most out the technology purchases by allowing educators to teach in ways that were not possible before the purchase. For school districts looking to implement 1:1, the only innovative

uses with computers were in school districts with 1:1 programs. So, for school districts looking to reach that innovative level with computers, a 1:1 adoption would be beneficial. This however does not bar school districts who cannot afford or have not adopted 1:1 from using technology innovatively. Figure 7 shows that display technology, such as projectors and smartboards (something 91% of respondents observed according to Appendices B2), provide another avenue towards innovative implementation by educators. This would allow school districts to still reach the standards while not having to make such a large investment in 1:1 if they cannot afford or choose not to do so.

These results are all in light of the limitations of the survey, the limited number of responses and overall lack of creating clear and specific survey questions. These limitations create questions for further research, such as exploring specific examples of innovative uses, which could contribute to meaningful professional development and help move school districts with 1:1 out of the predominant uses of technology for conventional means to more innovative uses. This could be done with examples of innovative uses that can be implemented across content areas.

Even with the limitations of this research, there is still valuable information to take away. Iowa school districts are a long way from reaching their full potential of technology integration. The millions of dollars spent are not being fully utilized, as seen in the predominance of conventional uses of technology in the classroom. This is possibly due to teacher uncomfortableness or lack of concrete examples of innovative uses of technology. The results of this research could have broad implications for school districts making technology purchase decisions, steering them towards computer integration or display integration depending on the budget. With further research that addresses the limitations of this thesis, a clearer picture of the

technology implementation of Iowa could be created, which could affect the state's educational policies, school districts purchasing decisions, and educators' integration of technology in the classroom.

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Appendix A Getting to Know You

Appendices A1 What is your age?

Age	Percent Response
19	14%
20	50%
21	27%
22	0%
23+	9%

Appendices A2 What is your major or intended major?

Major	Percent Response
Elementary Education	50%
Elementary and Middle Level Education	27%
Early Childhood Education	9%
Elementary and Other Education	14%

Appendices A3 What best describes how long you have been in college (UNI and/or other?)

Year	Percent Response
First Year	9%
Second Year	41%
Third Year	41%

Fourth Year	9%
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Appendices A4 Did you attend an Iowa public high school?

Answer	Percent Response
Yes	100%
No	0%

Appendix B Technology Observed

Appendices B1 Did your high school have wireless internet access across campus?

Answer	Percent Response
Yes	100%
No	0%

Appendices B2 What type of technology was seen in the classroom? Mark all that apply

Technology Seen	Percent Response
Projector	91%
Smartboard	60%
Teacher Computers	100%
Student Computers	32%
Cell Phones	60%

Appendices B3 Were computers allowed for student use seen in your classroom?

Answer	Percent Response
Yes	68%
No	32%

Appendix C Student Computer Information

Appendices C1 What was the computer type?

Computer Type	Percent Response
Windows Computer	40%
Mac Computer	33%
Linux Computer	0%
iPad tablet	5%
Android Tablet	0%
Windows Tablet	0%
Chromebooks	33%
Netbook	0%

Appendices C2 What form of computer integration did your high school have?

Computer Integration	Percent Response
1:1	40%
BYOD	7%
Combination of 1:1 and BYOD	20%

Computer Lab	40%
Mobile Cart System	33%
Other	7%

Appendix D Innovation with 1:1

Appendices D1 Did your high school teacher use or allow you to use the technology in school for a purpose that required that technology, for example creating a class wiki or an audio/video presentation?

Answer	Percent Response
Yes	89%
No	0%
Sometimes	11%

Appendices D2 Did your high school teacher use or allow you to use the technology in school for a purpose that did not necessarily require the technology, for example taking a test or notes?

Answer	Percent Response
Yes	67%
No	11%
Sometimes	22%

Appendices D3 Did you ever use your computer in high school for something that could have been done on paper?

Answer	Percent Reponses
Yes	100%
No	0%

Appendices D4 Was there an experience when you used your computer in high school that you could not have done before having one in the classroom?

Answer	Percent Response
Yes	78%
No	22%

Appendices D5 Mark at what level you observed the use of technology in high school For this question, “conventional” refers to using technology as a replacement for an activity that could have been completed with pen and paper.

	Not observed in classroom	Only teacher uses technology	Both student and teacher use technology, but infrequently	Both use technology, but for conventional means	Both use technology in new, interesting ways	N/A
Computer Integration	0%	0%	22%	56%	22%	0%
Mobile Technology Integration	22%	22%	22%	22%	11%	22%
Projector, smartboard, and other display technologies integration	0%	22%	11%	11%	44%	11%

Appendices D6 Did you find that having a student computer was beneficial to your academic high school career?

Answer	Percent Response
Yes	67%
No	22%
Other	11%

Appendix E Innovation without 1:1

Appendices E1 Did your high school teacher use or allow you to use the technology in school for a purpose that required that technology, for example creating a class wiki or an audio/video presentation?

Answer	Percent Response
Yes	80%
No	20%

Appendices E2 Did your high school teacher use or allow you to use the technology in school for a purpose that did not necessarily require the technology, for example taking a test or notes?

Answer	Percent Response
Yes	0%
No	40%
Sometimes	60%

Appendices E3 Did you ever use your computer in high school for something that could have been done on paper?

Answer	Percent Response
Yes	80%
No	20%

Appendices E4 Was there an experience when you used your computer in high school that you could not have done before having one in the classroom?

Answer	Percent Response
Yes	50%
No	50%

Appendices E5 Mark at what level you observed the use of technology in high school For this question, “conventional” refers to using technology as a replacement for an activity that could have been completed with pen and paper.

	Not observed in classroom	Only teacher uses technology	Both student and teacher use technology, but infrequently	Both use technology, but for conventional means	Both use technology in new, interesting ways	N/A
Computer Integration	0%	20%	20%	60%	0%	0%
Mobile Technology Integration	0%	0%	80%	20%	0%	0%
Projector, smartboard, and other display technologies integration	0%	0%	40%	20%	40%	0%

Appendices E6 Did you find that having a student computer was beneficial to your academic high school career?

Answer	Percent Response
Yes	60%
No	20%
Other	20%