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Title

Degrees of Freedom: An Exploratory Case Study of 1:1 Apple iPad Use in Secondary Education

Introduction

The various technological interventions in schools that are intended to increase achievement, computational thinking and computer literacy, and the acquisition of 21st century skills are here to stay. As discussed in the following literature review, educational researchers are highly interested in the effectiveness of these interventions for what they are designed to do. This problem has been approached from several different angles, in a number of different contexts, and with varying methods. Teacher training with technology is receiving attention, as are task re-design and considerations for digital equity. However, the way that these technologies are implemented by schools and districts with respect to student freedoms and student self-regulation has yet to be explored in depth and is the focus of this research study.

As schools have deployed more devices directly to the hands and backpacks of students, they have complied with laws such as the Children's Internet Protection Act, Children's Online Privacy & Protection Act, and Family Educational Rights and Privacy Act. These laws require that schools adopt Internet safety policies, filter Internet content for obscene and harmful materials, take reasonable steps to prevent the disclosure of student personal information, and secure the educational records of students from unauthorized access. A key question for schools is how stringently to implement these safeguards. Also at issue is whether it is the school's responsibility to continue to implement safeguards on school-owned devices that are in use

outside of the school day, unattached to the school's network, and off the school's premises. While some schools choose to filter school devices while they are at home, and others do not, it raises other questions about what students are allowed to do with their 1:1 devices.

Some schools intentionally blur the line between student use of devices that is personal and school related. In a conversation with one school official, they noted that after students graduate and pursue professional and higher education opportunities, they will more than likely be required to responsibly manage their personal interests and professional obligations from the same computing device. Young adults use the same computer to play games and watch YouTube videos as they do to complete college assignments or correspond with colleagues and clients. In order to meet others' expectations and achieve their own goals, these individuals will need to understand when it is appropriate to use a computing device for "play" and when it must be used for "work." In the mind of this educator, how can students learn these self-regulating skills if, when schools give them the same types of computing devices they will use as adults, they are completely denied the opportunity to experiment with work and play on the same device by only being allowed to access "work"-related materials and websites?

A conversation with another official in the same district revealed an even more fundamental unwillingness to enforce school policies outside the walls of the school when they declined to explore options for providing school-funded Internet access to homes without it during the COVID-19 pandemic. This initiative could have helped close the so-called Homework Gap in a district that was sending home devices and assignments that required access to the Internet. However, the individual cited two primary reasons for the decision not to move forward: ensuring that all families have Internet access is not the school's responsibility, and

local Internet service providers are already providing low-cost options to connect households with modest bandwidth to complete distance learning.

These two conversations in particular can explain the following educational technology decisions made by the district:

- Student Internet access in the building will be filtered and monitored using CIPA-compliant technology only to the extent that it will protect children from obscene and harmful material while online.

- School-owned devices used by students of any age will not be filtered or monitored in any way when the device attaches to a network that is not operated by the school district.

- School-owned iPads used by high school students will not be restricted to purely school-related websites and apps. All high school students will be allowed to make personal music and app purchases with their personal Apple ID, and load their personal photo library, alongside school-owned apps and resources licensed to the device.

- All junior high students will likewise be allowed to make personal music purchases with their personal Apple ID and will not be restricted to purely school-related websites, though the ability to download personal/non-school-related apps will be disabled.

- Restrictions on the types of personal apps and music allowed on the school-owned devices will be limited to those which protect students from obscene and harmful material, including adult-themed apps and explicit music and books; though web access while not at school will remain completely unfiltered and un-monitored.

In the context of the "hands off" and "let them explore" beliefs held by some school officials, these policies make clear that while the school is providing the device to the student, it

is not the school's responsibility to exert very much control over that device while it is not on school grounds.

This exploratory case study seeks to answer a simple research question: What are students doing with this freedom? Without making a formal hypothesis or generalizing conclusions, this study will observe in detail what students choose to do when they are tasked with completing homework assignments on a device which also has almost all of the games, websites, and music they could want. The subjects for this study will be nine secondary students whose every hour spent using the iPad will be recorded over a span of three school quarters, or about seven calendar months. These observations will be made with the state-of-the-art screen time monitoring capabilities provided by Apple to parents and educators. The study will be noninvasive and nonexperimental in nature.

Review of Literature

The research proposed in this study has few, if any, exact analogues in the recent body of literature, but several studies are conducted with similar methods, contain concerns by research participants of the topics addressed in this study, or highlight through researcher narrative a need for this type of research. Thus, a review of this literature is helpful to determine the context for this study, despite there being few models for standard ways to approach the research question.

First, a common theme throughout research in educational technology is self-justification. Academics feel that the research they are conducting about educational technology is critically important to validate the effectiveness or ineffectiveness of various initiatives adopted by local educational agencies. Al-Bogami and Elyas (2020) point out that "technology has been indisputably woven into the tapestry of education" (p. 1), and go on to state that "research-based insight is necessary" to determine the pedagogical value of technology such as iPads, particularly

as they relate to measurable improvements in student engagement and learning (p. 2). Other researchers are more candid about the gaps that exist between evidence-based theory and actual implementation practices. One paper reveals, "The iPad has great potential to have an impact on the educational growth of the district's middle school students. However, there has been no review into how the initiative is being received or its effectiveness" (Sullivan, 2019, p. 2); while another claims, "Gaps in the literature related to iPad implementation models and integration techniques are evident. Research is needed to determine how classroom teachers are implementing policy to integrate iPads as an instructional tool" (Moore, 2021, p. 4).

A theme that is somewhat nascent in the field is that of stakeholder perceptions about technology use. This area of study has the potential to illuminate inequities, inefficiencies, and other real problems that different research methods may not fully capture. Important for the present study are a selection of examples of perceptions from principals, parents, students, and teachers.

The vast majority of principals (95%) believe that students spend too much time on electronic devices at home; but only 17% of principals believe that too much time is spent on electronic devices at school (Education Week, 2018). Principals, nevertheless, are welcoming of new technology trends, particularly those which promise personalized learning (Herold, 2018). The perceptions of principals are important to understand because they are seen as the "gatekeepers" through which all new educational paradigms flow, including those having to do with technology.

As schools transitioned to distance learning during the COVID-19 pandemic, parents desired "a balance of online and offline activities, particularly for younger students" (Simpson, 2020, p. 41). Maxwell et al. (2021) showed that parents are generally in support of using

technology in schools. When asked to consider technology use at home, some parents revealed that they required their child to ask permission before using any technology, some provided direct supervision while the technology use was occurring, and some "relied on trust" that the student knew how to self-regulate screen time and browse appropriate content (Maxwell et al., 2021, p. 5).

Teachers' excitement (or lack thereof) can be rationalized by a diversity of self-reported themes, including, as analyzed by Liu, et al. (2016, p. 167):

Excited

- An opportunity to incorporate technology into instruction

- A way to engage the students

- Viewing iPad use as a new way of learning and teaching

- An opportunity for teachers to learn new things

Reluctant

- Lack of time

- Too few iPads in the classroom

- Students being distracted by iPad use

- Perceptions that technology trainings were not helpful

Liu, et al. also note that "While using iPads in the classroom can engage students, they can also be a distraction" (2016, p. 171). This last statement is highly representative of the depth of analysis afforded to the concept of technological distraction in much of the extant educational research literature.

Perhaps surprisingly, the greatest level of detail about students being distracted by their iPads has come from students themselves. Ge et al. have provided a stark picture of the way

students use their devices, and this contributes to the pressing body of evidence for the need for further study. The potential for devices to distract students from their learning was the most common way that they described the device impeding their education (Ge et al., 2021). Students are distracted both by their own device, with notifications and games tempting them away from school-related iPad activities, and by other students, who may be giving into these temptations and disrupting the focused learning atmosphere. Teachers often need to spend time addressing misuse, and students self-report that they often "play games during free time instead of reading books" (Ge et al., 2021, p. 80). While Ge's et al. study reported qualitative data about student iPad use, it was dependent upon the honesty and accuracy of students' estimations. For example, how often is "sometimes?"

Distraction is a key focus of the present exploratory case study. While this has not been the focus of most peer-reviewed research, the Internet is rife with examples of schools paying the price for student distraction. In Australia, one private school completely decommissioned their 1:1 iPad program when they found "the iPads were distracting and did not contribute to students' technology skills" (Baker, 2019). In Ireland, a report from Ratoath College found that while increased access to computing devices did not noticeably increase cyberbullying or access to inappropriate online content, distraction was a key theme. When teachers were engaged in instruction, it was "a matter of concern" that students would frequently switch over to games, online shopping, and social media on their device (O'Brien, 2020). Ultimately, another secondary school re-instated hard-copy instruction as a result of the report.

A final theme of the literature is the extent to which schools should monitor and filter student access to the Internet. Nantais and Cockerline (2010) admit that Internet access to students outside of school is generally "wide-open" and they argue against schools filtering Web

and application content. They claim that filtering software does not work, it denies students of their rights to be educated, and that there are better solutions to the problem anyway. They would find some agreement in the administrative offices of the school that is the focus of the present study, which, though complying with applicable laws, generally does not restrict student devices. The authors go on to state that, "Ultimately… students must be placed in the role of context providers, quality controllers, and guides" (Nantai S & Cockerline, 2010, p. 52), which is in line with this school's philosophy and Al-Bogami's and Elyas's constructivist framework (Al-Bogami & Elyas, 2020, p. 2).

However, it could be argued that more access could beget more distraction. Neuroscience researcher Mike Hobbiss has said that the areas of adolescents' brains in charge of "cognitive control" have yet to be fully developed, and "This [combined with] greater social freedom… is what can lead to harmful consequences" (Brookman-Byrne, 2017). He also argues that it is multitasking with electronic devices that is leading to poorer educational outcomes, rather than more nebulous ideas of screen time damaging attention span or technology being inherently bad for developing brains. In this context, it would seem that restricting access to non-school-related apps and websites as much as possible would have a positive effect on learning.

This exploratory case study will determine with quantitative clarity the iPad usage patterns of individual students enrolled in a 1:1 iPad program that was designed intentionally to afford them significant freedoms on the device. These include availability of the App Store for personal purchases, music downloads, and unfiltered Internet access while off-campus. It is not within the scope of this exploratory case study to make comparisons between students, draw conclusions about how emergent patterns are related to the policies governing the 1:1 program, or generalize findings to the broader school population or other schools and 1:1 programs at

large. However, this study is intended to lay the groundwork for those questions to be explored and answered.

This empirical research study is of the descriptive or non-experimental type, and the kind of research could be categorized as simple. The case study method, defined by Patten and Newhart (2018) as a technique that focuses on a single or small number of "cases" of a phenomena or event (p. 174), has been chosen for several reasons. Case studies are applicable to a small sample of students (nine, in this case), they allow for manageable longitudinal data collection, and they consider the context of the research participants. An exploratory case study is designed to prove that additional research is needed about a topic, and could be a precursor to more large-scale research (Universal Class, n.d.). The present case study is categorized as exploratory due to the demonstrated need for a basic understanding of "what" students are doing with their school-issued iPads and a desire to build a foundation for future experimental research in this area. The formal research question for this study is, "What are students doing with the time they spend on their school-owned iPads during school and outside of the school day?"

Method

Participants

The study will be conducted in a PK-12 public school which has implemented a 1:1 technology program with Apple iPads. All students in the school are assigned an iPad for educational use. iPads for students in Pre-Kindergarten through Grade 6 remain in the building at the conclusion of each school day, while the iPads of students in Grades 7 through 12 are allowed to leave the building. It is the latter group, which comprises over 100 students, from which the sample for this study will be drawn.

The sampling method employed will be a stratified random sample. This is defined by Patten and Newhart (2018) as a sample that "first create[s] homogenous groups from the population, and then make[s] a proportional but random selection from each of the groups" (p. 95). For this study, the population will be stratified into two groups by grade level – junior high (Grades 7 and 8) and high school (Grades 9 through 12). Further research derived from this exploratory case study could use the same instruments and procedures – along with hypotheses generated from correlations that are discovered – to collect data from different strata, such as those separated by gender, academic performance, household income, and race and ethnicity.

This stratification has been selected to match the purpose of the study. High school students are afforded significant freedoms with their iPad at this school, including the ability to use their personal Apple ID to purchase and download apps, music, and movies to the device that are not school related or even used for educational purposes. Junior high students, on the other hand, have fewer of these privileges, but they are allowed to download music to the iPad without access to the App Store. Dividing the population at this level will provide the basis for future research.

A sample of six students will be selected at random from the high school group. Each high school student will have an equal chance of being selected, regardless of their actual grade level (though grade levels and basic demographic information will be collected). In order maintain the proportion of the population, only three students from the junior high grades will be selected. This will also be done at random, with each junior high student having an equal chance of being selected. A total of nine students will comprise the data sources for this case study. Demographic information for the school community at large is provided by the school district:

- average household income: $51,000

- free and reduced-price lunch population: 51.24%

- race and ethnicity: 92% White; 7% Hispanic; 1% other races and ethnicities

Instruments

After a stratified random sample of nine students has been determined, informed consent will be obtained in writing from the student and his or her legal guardian. An electronic survey of about ten questions will be sent to the parent to collect data about family demographics and various other perceptions, opinions, beliefs, and attitudes related to their child's use of an iPad at school and at home. An interview will be conducted with each student individually to obtain similar data, but with more detailed questions about daily iPad use, including a ranking of the classes in which the student uses their iPad the most (for educational or non-educational reasons). This interview will be less than twenty minutes and contain less than twelve questions. Three digital instruments will together collect most of the quantitative data in the study: the iPad's Screen Time feature, data from the Apple Classroom app provided by each of the students' teachers, and other system information gathered from the school's mobile device management server. Information obtained from these sources will include how often certain apps were used and at what points of the day, as well as detailed time-on-task measurements during a sample of the student's class periods. The academic records of each student will be provided by the school administration, and at the conclusion of the study, an exit survey will be presented to students and parents to ascertain their estimates of student screen time, time on task, and effect of the iPad on their learning.

Procedures

The time frame for the study is modeled after Fairlie and Robinson's (2013) research that began in the second quarter of a school year and continued through the fourth quarter. This

allowed students to get acclimated to the new school year and develop their study and technology use habits before being measured. It also allowed researchers to conduct their preliminary data collection (Fairlie & Robinson, Jonathan, 2013, p. 216). For the present study, the sampling, consent process, and survey or interview will all be completed during the first quarter of the school year. Data collection will begin at the second quarter and continue through the end of the school year.

At the commencement of the study, the researcher will activate the Screen Time feature on the iPad and lock it with a passcode to prevent students from inadvertently or purposefully tampering with it. Every Sunday thereafter, for the duration of the study, students will submit to the researcher via electronic drop-box various screenshots of the past week's usage activities. In addition, at several random times throughout the school year, students will be required to submit a detailed Screen Time report from one specific day. Self-reported information from the pre-study interview will be used to determine the student's top three "iPad-active" classes. For each of these classes, six weeks will be randomly selected from the school calendar. For each week, the teacher of the class will be instructed to submit to the researcher via electronic drop-box a screenshot of the student's Apple Classroom monitoring data from every day that week.

The study will end with the school year. At this time, participants will return their iPad and they and their parents will complete exit surveys to gauge end-of-year self-assessments of the value of the iPad as an educational tool, screen time, and time-on-task estimates. Academic performance data will be obtained from the school district and paired with the Screen Time and Classroom app data, and the qualitative data from the surveys and interviews.

Data Collection

The initial parent surveys and student interviews will aim to collect primarily qualitative data about perceptions, opinions, beliefs, and attitudes. According to interQ (2021), perceptions are mental images that have been filtered through personal experiences. Some perception questions will include:

- "Do you feel that having an iPad is helping you learn?"

- "To what degree would you rate the iPad as being a distraction from your schoolwork?"

- "How often do you think that your child spends too much time on their iPad?"

Opinions are similar to perceptions in that they are based on a person's experiences, but they usually arise in relation to a set of facts (interQ, 2021). Examples of questions about opinions would be:

- "Is the school involved not enough, just the right amount, or too much in monitoring, filtering, and controlling school-owned devices when they are away from school?"

- "Do your teachers provide not enough, just the right number, or too many iPad-based assignments?"

Beliefs "form people's values, determine where people place their trust, and are harder to change than perceptions and opinions" (interQ, 2021), and they may help researchers understand the reasoning behind certain opinions. Two belief-oriented questions in the study are:

- "Should students be allowed to download games on school-owned devices?"

- "Are adolescents capable of independently balancing work and play on the same device?"

Finally, attitudes are described by interQ (2021) as an emotional position that someone holds about a fact or statement. Questions designed to elicit responses about attitude might be:

- "How likely are you to enforce limits on your child's screen time? Why or why not?"

- "When you know you have an assignment to work on either in class or at home, how do you decide whether and when to complete it?"

Each of these types of questions forces parents and students to approach the research topic from a slightly different angle, sometimes through introspection, and sometimes through generalization. Some survey questions even ask participants to rate the amounts of screen time and distraction they perceive in their peers.

The Screen Time feature of the iPad was introduced by Apple in 2018 as part of a suite of digital wellness features. According to Sarah Perez of TechCrunch (2018), "This full activity report will show you how much time your[sic] spending on your device and in apps, and how that breaks down per day" (para. 4). For this study, students will submit to the researcher via electronic drop-box a selection of screenshots of these reports at the end of each week. Data included in the screenshots will comprise:

- Total screen time

- Daily average screen time

- Total screen time per app category (e.g., social media, productivity, entertainment, etc.)

- Most used apps or websites and the screen time totals for each

The Screen Time functionality includes options for restricting usage of certain apps to only certain times of day and restricting the use of certain apps after a certain amount of screen time on them has been logged. Due to the diagnostic nature of this exploratory case study, these restrictive settings will not be used and no attempt to interfere with the student's normal use of the iPad will be made by the researcher.

The Apple Classroom app is a tool used by teachers in the classroom to monitor and place restrictions on student devices in real time. It was first released in 2016 and uses a

combination of Wi-Fi and Bluetooth technology to connect student and teacher devices. Using the app, teachers can lock student iPads to make them non-functional, view screens, open and lock students in apps and websites, and send and receive files. At the conclusion of a Classroom session, the app will display a timeline graphic for each student that spans the duration of the session. Within each timeline is shown a second-by-second log of which apps students were using at which times, and for how long. The securing of this data is key to developing a clear picture of how students use their devices during a class period.

In the initial student interview, students will be asked to rank their classes from high to low by how much time they usually spend on their iPad in each of them. Students will be asked to make these rankings based on total iPad usage including that which is off-task or non-school-related. The goal is to capture as much of a student's iPad activity as possible. From these results, the top three classes will be the subjects of the Apple Classroom portion of the study.

For each of these three classes, six weeks will be randomly selected from the study period in another stratified random sample – two weeks from the second quarter, two weeks from the third, and two weeks from the fourth. For each of these weeks, the teacher will keep active a Classroom session for the entirety of the class period every day. At the end of each day, the teacher will screenshot the summary timeline of the student and submit it to the researcher via electronic drop-box. At the end of the study, there will be a total of 90 class periods that have been recorded for each student – 10 for each of the three classes in each of the three quarters in the study. This dataset will provide a detailed picture of over 300,000 seconds of iPad use in the classroom per student. It is particularly notable that this data can be collected passively by the classroom teacher with no additional support or intervention.

Additional metrics can be obtained from the school's mobile device management server. This information can help the researcher determine patterns for battery usage, storage usage, network connectivity at home and at school, and app installations.

Data Analysis

For this initial research, data will be analyzed only on a case-by-case basis to determine the iPad usage patterns of individual students. Readers may develop new research questions or feel compelled to draw comparative conclusions on their own. This highlights the need for more targeted research in the area of student freedoms as they relate to technology and learning. Much of the data will be analyzed only to the extent that it can be made digestible. Interview and open-ended survey responses will be summarized and quoted where appropriate. Screen Time data for each student will be averaged by quarter with anomalies and outliers noted. Classroom app data will be aggregated by course for each student, then averaged by quarter in a similar way. Because this study makes no formal hypothesis, there is little need at this time for statistical tests beyond simple regression models which may aid in finding correlations.

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