

## ABSTRACT

### Examining Teachers' Observations of a 1:1 Implementation's Impacts on High School Students' Communication and Social Skills: A Qualitative Case Study

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One-to-one (1:1) student-to-laptop programs proliferate K–12 school settings in the United States and elsewhere, but it remains difficult to determine the extent to which these programs contribute to meaningful and positive change for students and teachers (Bebell & Kay, 2010; Bebell & O'Dwyer, 2010; Bleyer, 2017; Kposowa & Valdez, 2013; Muniz, 2018; Robinson, 2018; Sauers & McLeod, 2018; Zheng et al., 2013). There is a dearth of comprehensive, conclusive studies examining 1:1 initiatives' effectiveness (Bebell & Kay, 2010, p. 6; Mouza, 2008, p. 469; Sauers & McLeod, 2018; Warschauer et al., 2014; Zheng et al., 2016), and 1:1 programs' growth and costs warrant further research to fill gaps in the literature. In particular, there are too few studies exploring how students' communication and social preferences, behaviors, and skills are impacted once these students receive district-issued devices. Those best positioned to account for these changes are students' teachers. Since teachers are essential to 1:1 implementations' successes, researchers exploring 1:1 education must periodically solicit teachers' opinions. This qualitative case study explores high school teachers' observations of a 1:1

implementation's impacts to students' communication and social skills. By focusing on teachers' observations of these impacts, this study highlights how educators at one high school regard a 1:1 implementation's impacts on students, its resultant changes to social interaction in and out of classrooms, and its changes to schools' nature.

As K–12 students' and teachers' experiences in 1:1 programs increasingly transpire within digitally immersive contexts, this study aims to answer the following research question: what impacts on students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? Since 1:1 device initiatives represent a fundamental shift in both pedagogy and learning, these changes warrant further study. Among aspects of 1:1 programs warranting further consideration are those involving digitally immersive education's nonacademic impacts: how communication and socialization change in such contexts. This study examines teachers' perceptions of these impacts on students and offers recommendations for addressing these impacts.

Examining Teachers' Observations of a 1:1 Implementation's Impacts to High School  
Students' Communication and Social Skills: A Qualitative Case Study

by

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A Dissertation

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## TABLE OF CONTENTS

LIST OF FIGURES .....	vii
LIST OF TABLES .....	viii
ACKNOWLEDGMENTS .....	ix
DEDICATION .....	xiv
CHAPTER ONE .....	1
Introduction .....	1
Introduction .....	1
Statement of the Problem .....	3
Purpose of the Study .....	11
Conceptual Frameworks .....	12
Research Design .....	15
Definition of Key Terms .....	16
Conclusion .....	20
CHAPTER TWO .....	22
Literature Review .....	22
Introduction .....	22
Public Sector Educational Technology Initiatives .....	23
Private Sector Educational Technology Initiatives .....	33
Two Statewide 1:1 Initiatives .....	38
Research Syntheses and Meta-Analyses .....	45
Implementation Considerations .....	48
The 1:1 Model as Experienced by Administrators, Teachers, and Students .....	55
Conclusion .....	67
CHAPTER THREE .....	74
Methodology .....	74
Introduction .....	74
Researcher Perspective .....	75
Theoretical Frameworks .....	77
Research Design .....	80
Data Collection .....	83
Data Analysis .....	89
Data Validation .....	90
Limitations and Delimitations .....	91
Ethical Considerations .....	92
Conclusion .....	93
CHAPTER FOUR .....	95
Results .....	95
Introduction .....	95
Questionnaire Results .....	99
Questionnaire Results: Emergent Themes .....	106

Participants.....	118
Participants' Results: Emergent Themes .....	153
Conclusion .....	168
CHAPTER FIVE .....	169
Discussion and Implications .....	169
Introduction.....	169
Discussion of Significant Findings Related to the Research Question.....	169
Summary of Significant Findings .....	170
Interpretation of Findings.....	181
Implications and Recommendations for Educational Practice .....	183
Recommendations for Future Research .....	187
Personal Reflection .....	188
Conclusion .....	190
APPENDICES .....	192
APPENDIX A.....	193
Questionnaire: Consent Form .....	193
APPENDIX B.....	194
Questionnaire: Demographic Questions .....	194
APPENDIX C.....	195
Questionnaire: Content Questions .....	195
APPENDIX D.....	196
Open-Ended Sentence Stems 1–2 .....	196
APPENDIX E.....	197
Open-Ended Sentence Stems 3–6 .....	197
APPENDIX F.....	198
IRB Approval Exemption Request Email.....	198
APPENDIX G.....	200
IRB Exemption Approval Email Response .....	200
APPENDIX H.....	201
Participant Consent Form .....	201
APPENDIX I .....	208
Board of Education Minutes: Research Study Approval.....	208
BIBLIOGRAPHY.....	209

## LIST OF FIGURES

<i>Figure 4.1.</i> Questionnaire respondents by academic department .....	99
<i>Figure 4.2.</i> Participant responses referencing students' personal devices.....	106
<i>Figure 4.3.</i> Respondents' observed changes to students' communication, social skills .....	119
<i>Figure 4.4.</i> Study participants aligned according to data collection protocols.....	120
<i>Figure 4.5.</i> Participants' diction in student engagement definitions .....	154
<i>Figure 4.6.</i> Did participants observe impacts according to the research question?.....	171

## LIST OF TABLES

Table 4.1 <i>Question One: Observed Changes in Primary Instructional Spaces</i> .....	101
Table 4.2 <i>Question One: Nature of Changes in Primary Instructional Spaces</i> .....	101
Table 4.3 <i>Question Two: Observed Changes in Social Spaces</i> .....	102
Table 4.4 <i>Question Two: Nature of Changes in Social Spaces</i> .....	103
Table 4.5 <i>Question Three: Overall Observed Changes</i> .....	104
Table 4.6 <i>Question Three: Overall Nature of Changes</i> .....	104
Table 4.7 <i>Did Participants Observe Impacts to Students' Communication and Social Skills?</i> .....	171

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## DEDICATION

To my grandmother, Joyce Bourg: the greatest English teacher of all time.

When I told you that I too would teach high school English, you tried to talk me out of it.

Eventually, you relented.

You said, “well, if you’re going to do it, you’d better be good at it.

There are plenty of lousy English teachers.”

If you are up there, looking down on me, I hope you think that I’m good at it.

If you are up there, looking down on me, I also hope you’re still correcting my grammar.

## CHAPTER ONE

### Introduction

#### *Introduction*

The one-to-one (1:1) student-to-device distribution structure is a popular model for educational institutions seeking to solidify personal computers' roles within the instructional process (Bebell & O'Dwyer, 2010; Donovan et al., 2007; Penuel, 2006; Sell et al., 2012; Valiente, 2010). This digitally immersive environment offers exciting possibilities for improving education in K–12 American public school classrooms. At the same time, there is a shortage of evidence regarding the 1:1 model's overall benefit to teachers and students (Abell Foundation, 2008, p. 17; Bebell & Kay, 2010, p. 6; Bebell & O'Dwyer, 2010, pp. 12-13; Penuel, 2006; Zheng et al., 2016). Within existing evidence, there is a lack of research consensus as to what benefits the 1:1 student-to-device distribution structure provides (Bebell & Kay, 2010, p. 6; Mouza, 2008, p. 469; Sauers & McLeod, 2018; Warschauer et al., 2014; Zheng et al., 2016). In addition, a gap in research literature exists in the area of behavioral consequences. Too little 1:1 research pertains to changes that teachers and students experience when more of their time is spent interacting with their devices and less of their time is spent interacting with peers or teachers (Sauers & McLeod, 2018).

One-to-one programs became popular over the past two decades—without commensurate scrutiny or research—due to recent drops in device costs (Zheng et al., 2016, p. 1053) and decades of educational technology advocacy from public and private sector actors. Internet-connected laptop computers' newfound affordability allows school

administrators to pivot educational technology resource allocation from a model incorporating fixed or mobile computer labs to a model comprised of independently issued devices. While 1:1 programs are nominally considered recent phenomena—their origins lying within localized efforts in early-1990s Australian private schools (Johnstone, 2003)—various stakeholders sought to increase students’ and teachers’ educational computer access since the 1980s. These efforts are long-running and culled from diversified sectors, spanning government, education, and consumer technology.

Since the publication of *A Nation At Risk* (Gardner et al., 1983), public school districts, entire U.S. states, and publicly traded technology corporations (along with many other entities) have sought unhindered access to computers for students in K–12 schools. At the same time, private sector brands have long touted educational technology’s transformative nature. In the 1980s, Apple was an early educational technology pioneer from the private sector, implementing its *Classrooms of Tomorrow* initiative. The company installed desktop computers in school classrooms and monitored both teachers’ pedagogy and students’ learning with the new devices, kickstarting a nascent educational technology field (Dwyer et al., 1990).

Today, newly inexpensive hardware is coupled with cloud-based software suites to create immersive learning management ecosystems for teachers and students. For example, Google is only one of many companies providing a package of hardware, software, storage, and data solutions designed for students and teachers (Lindh & Nolin, 2016). While technology companies’ educational products and services ultimately come to an open market to make money, some evidence suggests that providing greater access to technology improves students’ educational outcomes (Stone, 2017). As device

capabilities develop and the internet grows steadily more ubiquitous and indispensable, what has not changed since the 1980s is the excitement and promise surrounding a vision of education that essentializes computers. This belief—more access to more high-quality devices in more contexts makes a critical difference for K–12 students and educators—merits further analysis. In the meantime, what has changed is the extent to which the 1:1 model already essentializes computers in classrooms.

### *Statement of the Problem*

The extent to which 1:1 laptop programs affect students’ and teachers’ learning and teaching does not reach consensus (Bebell & Kay, 2010; Bebell & O’Dwyer, 2010; Bleyer, 2017; Kposowa & Valdez, 2013; Muniz, 2018; Robinson, 2018; Sauers & McLeod, 2018; Zheng et al., 2013). In the absence of consensus, the stated aims, reasons, and justifications for 1:1 programs’ deployment vary (Penuel, 2006; Sauers & McLeod, 2018, p. 895; Stone, 2017, p. 2282; Warschauer et al., 2014, p. 58). This diversity of rationale is not, in itself, problematic. Schools’ stakeholders have localized needs and objectives, and these considerations understandably guide educational technology implementations. However, this diversity of rationale makes 1:1 research difficult to implement in practice. In particular, and despite some loosely-constructed best practices guiding implementation fidelity (Stone, 2017), “administrators are being forced to create policies they know little about” (Sauers & McLeod, 2018, p. 906). From this untenable position, then, teachers adopt potentially transformative educational technology without cohesive, research-based guidance.

Localized dynamics framing 1:1 program implementation have yielded many site-specific or site-focused studies at the expense of more expansive research efforts. This

makes finding 1:1 research consensus difficult. Since 1:1 implementations are complex in nature (Penuel, 2006) and locally varied, existing studies in this subject area often focus on particular elements within these implementations. These elements are as varied as they are numerous. Some studies consider 1:1 programs' merits according to administrative concerns (Anderson, 2007; Gherardi, 2017; Howard & Rennie, 2013; Robinson, 2008) or programs' educational evaluation metrics (Bleyer, 2017; Dudley, 2018; Hull & Duch, 2019; Kposowa & Valdez, 2013; Lowther et al., 2012), while still other studies focus on 1:1 programs' devices and software packages themselves (Bartolo, 2017; Lindh & Nolin, 2016). This resultant, segmented body of research into 1:1 programs is made more inscrutable by the perpetual churn of innovation. Administrators, teachers, and students wrangle each technological leap as it occurs.

In spite of such segmented research, many districts and schools want their students and teachers to have greater access to computers, even if they are not sure why this access matters. Some studies have found benefits for both students and teachers in 1:1 schools, but it is difficult to differentiate these benefits from the local circumstances that contributed to their presence. There remains a need for research evaluating the extent to which particular students in particular schools benefit from 1:1 initiatives (Sauers & McLeod, 2018, p. 906). Linking implementation factors, then, to the desirable outcomes found in 1:1 research could lead to substantive change for both students and teachers operating within this model.

To that end, among the factors to be considered in 1:1 programs are those of the devices themselves. This research specifically focuses on the effects of internet-connected laptop computers, as opposed to tablets or other devices. While studies focused

on other devices offer important findings and considerations for 1:1 research, the more comprehensive power of the laptop computer serves as a clear limitation for this study's literature review and focus.

Some evidence indicates that providing laptops to each student leads to positive educational outcomes (Jacob, 2020, p. 186). These outcomes include general improvements in educational climate, such as increases in collaboration (Bartolo, 2017, pp. 111-112; Windschitl & Sahl, 2002, p. 201), improved study skills, and increases in students' interest in learning tasks (Lowther et al., 2012, p. 25). Other evidence suggests promise in the area of student achievement. In one study, students in 1:1 contexts earned higher scores on English Language Arts (ELA) standardized tests (Bebell & Kay, 2010, pp. 6-7) while another study indicated students' levels of device use positively predicted mathematics scores (Shapley et al., p. 2010, p. 48).

Thought-provoking links between 1:1 implementations and teachers' pedagogy merit further study. Sauers and McLeod (2018) noted how adopting the 1:1 model had "a significant impact on teacher behaviors" (p. 906). Evidence suggests that implementing a 1:1 program can improve communication between teachers, students, and students' parents (Dillon, 2017, p. 169), offer opportunities for engaging students outside of the traditional classroom model (Strother, 2013, p. 86), and provide for more extensive differentiated instruction (Harper & Milman, 2016, p. 139). Which existing issues 1:1 implementations fix, how 1:1 structures fix these issues, and whether the risks—those of cost, privacy, education—are worth taking remain difficult questions to answer.

More than fifteen years ago, the first two statewide initiatives in the United States.—the Maine Learning and Technology Initiative (MLTI) and the Texas Immersion

Pilot (TIP)—endeavored to find out on a larger scale how a 1:1 implementation structure affects students and teachers. In 2003, Maine became the first U.S. state to implement a 1:1 laptop program for its middle school students under the premise that doing so would offer Maine’s students (regardless of individual circumstances) an advantage as they prepared for a dynamic occupational landscape after high school (McCarthy, 2001; Silvernail, 2011). When the State of Texas followed with a 1:1 pilot program of its own one year later, the state focused on the belief that immersing teachers and students in such a technology-rich environment was preferable to parceling out pieces of technology over time (Shapley et al., 2009).

By 2016, on the heels of several more state initiatives and still more research studies, and after many states had delegated 1:1 implementation responsibilities to local district leaders, Minnesota’s Department of Education acknowledged in its mandated report to the Legislature two realities that seem to undercut one another. First, over half of Minnesota schools had some form of a 1:1 structure in place. Second, there were (previous to the report’s release) no preexisting guidelines in place to suggest how, why, and under what circumstances schools ought to implement a 1:1 program (Minnesota Department of Education, 2016). That such a profound educational change proliferated at such a rapid pace without guidance from the state suggests a retroactive, rather than proactive, approach to understanding 1:1 programs at the state level.

Taken one way, Minnesota’s post-implementation, retroactive analysis reflects a surprisingly sparse sense of academic skepticism regarding 1:1 programs. Taken another way, the breakneck speed of 1:1 implementation could be interpreted as the technology’s rate of adoption outpacing the publication of rigorous research. To that end, the rate at

which the internet is already embedded within American public education should not be taken for granted. While 1:1 programs are not new, and while there remains a lack of consensus on the number of 1:1 programs in place at any given time in the U.S. (Anderson, 2007), their rise is clear and dramatic given the state of internet-connected laptop computers in schools just a short time ago. In 1995, the days of the internet's infancy, only eight percent of those computers present in American public schools were connected to the internet (Snyder et al., 2019, p. 192). Only five years later, in 2000, this figure rose to 77%. By 2008, 98% of schools' computers were connected to the internet (p. 192). Considering also that, as far back as 2001, before the ubiquity of both broadband and wireless networking, 99% of public schools in the United States had some degree of access to the internet (U.S. Department of Education, National Center for Education Statistics, 2002, p. 3), there remains a need for a cohesive understanding of the effects that both students and teachers have experienced, continue to experience, and will continue experiencing within their increasingly internet-connected schools (Lebo, 2014; Sauers & McLeod, 2018).

While these figures illustrate the swift implementation of internet connectivity within U.S. classrooms, some evidence suggests that researchers may need to look more critically at how and where computer use affects students' educational outcomes. One of the perceived benefits of 1:1 programs, in certain applications, is this device distribution structure's ability to address inequalities that exist for students who can, cannot, or are restricted from access to the internet away from school. This assumption's predication is based on the notion that more robust internet access leads to higher achievement for certain students, but there is some evidence to suggest that "disparities in computer use

may exacerbate the challenges that disadvantaged learners face” (Warschauer et al., 2014, p. 46). Vigdor et al. (2014) found that broadband internet access led to significantly lower scores for specific student populations (p. 1105). Perhaps more importantly, the researchers in the latter study suggested that parental involvement—already a factor related to students’ educational outcomes—could bear strongly on these results.

Nonetheless, many school districts have moved beyond fixed or mobile computer labs or “bring your own device” (BYOD) models—in which students and teachers may use their own devices in a shared system—in favor of the equity and access (Warschauer et al., 2014) that 1:1 structures are designed to foster. Still, both the 1:1 model (Sauers & McLeod, 2018, p. 895) and the BYOD model have garnered both criticism and praise. A 2019 literature review examining the differences between device distribution models “speculated that technical issues, productivity, organization and the quality of student work could be influenced by the quality of the device and the opportunity to choose preferred learning tools” (Kay & Schellenberg, 2019, p. 4) in reference to BYOD programs. In the name of “digital equity” and “increased technology access” (Warschauer et al., 2014, pp. 46-47) and perhaps also for financial, legal, or logistical reasons at the local administrative level, the 1:1 model reflects a more egalitarian educational ideal.

Missing from the critical discussion of the 1:1 model is how students’ and teachers’ behavioral health is affected when all parties have consistent and, inevitably, expected access to personal computers at school, at home, and those places in between. Clearly, 1:1 laptop initiatives are both well-intentioned and increasingly popular for ensuring students’ and teachers’ access to internet-connected education in the United States (Bebell & Kay, 2010; Detering, 2017; Donovan et al., 2007; Dudley, 2018; Muniz,

2018). Per socioeconomic status, per grade level, per ability level, and per discipline, determining how or if the 1:1 model improves equity, access, learning outcomes, personal satisfaction, engagement, and other metrics must be made clearer through more research (Sauers & McLeod, 2018, p. 906). Importantly, additional studies must focus on real-world, interpersonal changes wrought by a device distribution model that implies immersive digital engagement.

Researchers develop their understanding of such changes when they consider stakeholders' perceptions of teaching and learning in 1:1 programs. These perceptions are important in determining impacts incurred by these programs' participants (Jacob, 2020, p. 177). There are established links between implemented 1:1 programs and pedagogical adaptations for teachers (Donovan et al., 2007; Penuel, 2006; Sauers & McLeod, 2018). At the same time, it is worth exploring how 1:1 programs challenge teachers' paradigms (Gherardi, 2017; Hallman, 2019; Tallvid, 2016; Windschitl & Sahl, 2002). Students' paradigms may (dis)similarly be challenged, and by examining their lived experiences as well, researchers develop their understanding of how schooling changes in a 1:1 environment.

Studies examining students' attitudes toward educational technology in 1:1 contexts show inconsistent results. In one study, Berger-Tikochinski et al. (2016) found that some students' attitudes changed during the course of 1:1 implementations, from negative in the short term to a more positive view of the implementation when analyzed over longer periods (p. 186). Stone (2017) found that some of the displeasure students expressed in the early stages of a 1:1 implementation could be attributed in part to technical issues prevalent in the first stages of the 1:1 initiative (pp. 2305-2306). For both

students and teachers in 1:1 contexts, Lebo (2014) suggested that “the value of examining climate and culture as an opportunity to better understand avenues for school improvement was supported by a review of the literature” (pp. 70-71).

The literature-supported “value” that Lebo (2014) noted is revealed when teachers’ and students’ opinions are studied. Both teachers’ and students’ perceptions of the ways they use educational technology are valuable in determining the effects these technologies have on other relevant issues—such as peer relationships and teachers’ pedagogical processes. Of course, empirical studies examining 1:1 programs on quantitative indices reflecting students’ or teachers’ performances pre- and post-implementation are important, but so too are studies examining participants’ qualitative perceptions. Rorty (1980) supported this pragmatic valuation of such perceptions when he equivocated the manifestation of fact with the manifestation of belief (p. 723). Some 1:1 studies analyze educational technologies’ rate of adoption, others examine technologies’ effects on academic performance (Muniz, 2018; Vigdor et al., 2014). While these studies and others offer valuable insights, they too omit important context: how this rate of adoption *feels* to those adopting the educational technology. Making meaning of these stakeholders’ perceptions could be revelatory.

It is necessary to consider 1:1 implementations’ educational, pedagogical, and evaluative concerns alongside equally pressing concerns regarding the autonomy, privacy, and behavioral health of all stakeholders. One concern is the expectation that students and teachers are reachable—via email, messaging, or otherwise—outside the traditional hours of the school day. While students’ pivot toward cloud-based word processing software rather than papers and pencils to complete schoolwork may not

present a tremendous change in itself, it is a tremendous change when public school students and teachers store all (or some) of their schoolwork and personal information within businesses' servers or cloud storage. Teachers may not be cognizant of how their digital actions are monitored, and this surveillance is a tremendous change that warrants research.

This study is essential because 1:1 programs have exponentially changed the nature of K–12 landscape. With more understanding, more research, and more analysis of the many factors that impact 1:1 implementations, researchers can begin to confront the most fundamental challenge of all: how educational technology is beginning to shift the very nature of what constitutes “school.”

#### *Purpose of the Study*

This study explores the social impacts felt by high school students learning within a high school's 1:1 device distribution program. This study aims to discover the essence of students' experiences within this educational environment and device distribution model by examining teachers' perceptions of a 1:1 program as of this program's fourth and final year of implementation. This study also aims to examine how these experiences are shaped by students' computer use. While existing research acknowledges 1:1 programs alter students' (Stone, 2017, p. 2303) and teachers' educational experiences (Bebell & Kay 2010; Donovan et al., 2007; Gherardi, 2017; Hallman, 2019; Harper & Milman, 2016, p. 139; Tallvid, 2016; Windschitl & Sahl, 2002, p. 16), those closest to this phenomenon need to be more thoroughly represented so that they may describe, explain, and explore how these technologies affect their educational experiences. Teacher

consultation is necessary to determine how students' social lives are impacted as a result of the changes brought about by ubiquitous distribution of computers for educational use.

This study seeks to answer the following question: what impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? Exploring this question's answer offers important, too-often omitted information regarding lived experiences and structural changes that stakeholders feel in 1:1 programs. This study contributes to a more equitable, inclusive, comprehensive, and collective understanding of how the 1:1 model affects nonacademic facets of schools. This study seeks to find both meaning and patterns elicited from the most critical stakeholders in order to establish how both people and education change in the immersive educational technology structure that 1:1 education is.

### *Conceptual Frameworks*

Two frameworks guide this study: Technological Pedagogical Content Knowledge (TPACK) and the Concerns Based Adoption Model (CBAM). TPACK is a framework that acknowledges the notion that new, digital technologies "have changed the nature of the classroom or have the potential to do so" (Mishra & Koehler, 2006, p. 1023). Referencing Shulman's (1987) suggestion that isolating teachers' content knowledge from pedagogical knowledge within research capacities nullifies the value of each domain, Mishra and Koehler (2006) extend, again referencing Shulman's (1986) combination of pedagogical studies and teachers' content knowledge studies (pedagogical content knowledge, or PCK), to craft a framework that "emphasizes the connections, interactions, affordances, and constraints between and among content, pedagogy, and technology" (Mishra & Koehler, 2006, p. 1025).

This conceptual framework rejects the idea that “teachers simply need to be trained to use technology” (p. 1031). The relevance of this framework to this study is in the intersectional change, between technological and pedagogical knowledge, that 1:1 programs initiate. Acknowledging that teachers’ existing funds of technological knowledge are inextricably linked to their funds of pedagogical knowledge allows this framework to contextualize changes in a 1:1 program.

As this study also focuses on the effects that teachers feel both in and out of their classrooms, it does so under the philosophical assumption of technology’s situational importance. Mishra and Koehler (2006) argue that technology’s infusion without context-sensitivity is not recommended, as “despite valuable generic uses of technology (such as grade books), such approaches do not avail the full potential of technology for teaching specific subject matter” (p. 1032). Education—as a discipline, an active practice, and as a vocation—consists of unique sets of local challenges. Students, grouped by age and ability level, represent individual constructs too dynamic to ignore or marginalize in research of this nature.

Embedded within both this study and within the TPACK conceptual framework is the importance of context in educational technology infusion. TPACK posits

context-neutral approaches to technology integration encourage generic solutions to the problem of teaching. However, technology use in the classroom is context bound and is, or at least needs to be, dependent on subject matter, grade level, student background, and the kinds of computers and software programs available. (Mishra & Koehler, 2006, p. 1032)

Within this study, TPACK provides a framework in which the researcher can assess not only the effects computers have on education, but also the ongoing meaning-making and social effects incurred by stakeholders in 1:1 contexts.

Since 1:1 programs require stakeholders to both collectively assess and independently self-assess existing perspectives, applying an organizational change (the introduction of laptop computers) in an ongoing manner, the Concern-Based Adoption Model (CBAM) is also appropriate for framing this study. Developed in order to more clearly account for the innate complexities within the innovation adoption process taking place, specifically, within educational institutions (Hall, 1973, p. 1), the CBAM theoretical framework helps to conceptualize such a comprehensive change to teaching and learning in 1:1 programs. Hall, Wallace, and Dossett (1973) proposed that when changes are initiated in an educational environment, researchers must account for individual interpretation and application, observing that

an individual teacher may use a curriculum innovation while the rest of the school system does not; or a school system may use an innovation but may still have individual classrooms or schools where the innovation is unused or is used in a manner not intended by the developer. Further, there are developmental stages in the use of an innovation in educational settings that must be attended to if adoption is to proceed effectively. (p. 2)

This description emphasizes the CBAM's acknowledging the often disparate, uneven, and continuous changes happening within educational institutions. Accordingly, the CBAM framework is particularly useful for understanding 1:1 device deployment structures in which such concerns are present. Perhaps of equal importance, though, is the framing of 1:1 programs as constructs within the CBAM's classification of "educational innovation" (Hall, Wallace, & Dossett, 1973, pp. 2-3). There is denotative worth in understanding the 1:1 model's technologically immersive environment this way, but there is also connotative, contextual worth in understanding the laptop computers at the heart of the 1:1 model not as brand new, paradigm-shifting devices, but as innovative tools

whose adoption and deployment can be understood as falling within a long succession of such innovations.

### *Research Design*

This study was conducted according to an instrumental, bounded, qualitative case study design. It was bound by its location (one New Jersey high school) and its timing (a school district's fourth and final year phasing in a 1:1 implementation). This research design worked pragmatically, tolerating and valuing simultaneous, discordant realities (Stake, 1995, p. 12). These realities emerged after collecting and analyzing data from several sources. To develop a multifaceted, comprehensive understanding of this study's central phenomenon (i.e., the district's 1:1 implementation), these data sources were compared and analyzed in pursuit of Yin's (1994) rendering of "triangulation" (p. 13) within the case study design. These data collection and analysis stages elicited emic issues from "patterns, categories, and themes" (Creswell & Creswell, 2018, p. 181).

Using the bounded circumstances of the school and the 1:1 implementation's timing, this case study was instrumental in nature. This study "illustrates the issue" (Creswell & Poth, 2018, p. 98) at hand (i.e., prospective changes wrought by 1:1 initiatives) within the aforementioned, bounded constraints. By collecting and analyzing different teachers' diverse perspectives, and by allowing these diverse perspectives to coexist, this study examined "how the actors, the people being studied, see things" (Stake, 1995, p. 12). After analyzing these perspectives, this case study generated assertions in a manner consistent with case study design (Creswell & Poth, 2018, p. 104).

This case study research design was chosen over other design options. Among these options were the ethnography and the phenomenology. Though an ethnography was

apt for this study's participants' fixed location, this design's focus on ascertaining "shared patterns of behavior, beliefs, and language" (p. 90) made it a poor fit. This study sought to understand its participants' experiences irrespective of such commonalities. A phenomenological research design was considered, but this option centralized a "single concept or idea" (p. 76) that proved difficult to reconcile with this study's conception of a 1:1 implementation. Since phenomenological studies focus on "both subjective experiences of the phenomenon and objective experiences of something in common with other people" (p. 76), a phenomenological research design would have undesirably shifted focus toward parsing which aspects of teachers' experiences are shared or not shared. At the same time, these similarities and differences are important. They are—as evidenced by their appearance within this study—worthwhile and relevant inclusions. Still, this study was more focused on material conducive to the case study research design: portraying how "different and even contradictory views of what is happening" (Stake, 1995, p. 12) manifest, transpire, and coexist.

### *Definition of Key Terms*

*1:1* or *one-to-one*: two definitions follow. The first is a brief, but workable definition that merits inclusion as it is reflective of both popular understandings and the views expressed by some stakeholders within qualitative studies referenced here. In these contexts, 1:1 studies are programs or initiatives in which school districts provide personal computers to all students (Bebell & Kay, 2010). A more encompassing definition is the one that follows. This definition accounts for evident diversity among 1:1 issuing institutions (e.g., countries, states, organizations, individual schools, or departments within schools) and excludes related, but often distinct endeavors to

focus this study (e.g., tablets, smartphones, personal digital assistants). According to Penuel (2006), 1:1 programs can be understood as

a wide variety of initiatives as defining characteristics of one-to-one computing in the classroom: (1) providing students with use of portable laptop computers loaded with contemporary productivity software (e.g., word processing tools, spreadsheet tools, etc.), (2) enabling students to access the Internet through schools' wireless networks, and (3) a focus on using laptops to help complete academic tasks such as homework assignments, tests, and presentations. (p. 331)

*21<sup>st</sup>-Century Skills*: an umbrella term encompassing the collective understandings, occupational skills, and personality assets that education stakeholders (teachers, professors, administrators, etc.) and private-sector employers believe to be essential to both a successful education and a productive, working life in the modern world (“21<sup>st</sup>-Century Skills,” 2013).

*A Nation at Risk*: A 1983 report, commissioned by U.S. Secretary of Education, T.H. Bell and written by David P. Gardner on behalf of the National Committee on Excellence in Education, on the quality of U.S. education (Gardner et al., 1983, p. 6).

*Common Core State Standards*: a 2009, state-driven initiative by the National Governor's Association for Best Practices and the Council of Chief State School Officers that adapted individual U.S. states' learning standards for the purpose of crafting a set of consistent standards for U.S. schools (Common Core State Standards Development Process, 2020).

*Concerns-Based Adoption Model (CBAM)*: a conceptual framework for understanding educational innovations introduced to existent systems that “assume the existence of two primary systems—a user system and a resource system—and the establishment

of a temporary third system, a collaborative adoption system [...] for a multi-stage decision process” (Hall, Wallace, & Dossett, 1973, p. 7).

*English Language Arts (ELA)*: a content area that encapsulates (in the State of New Jersey) the development of reading skills (fiction and nonfiction, literature and informational texts), writing skills, and speaking and listening skills cultivated in schools (Siniari et al., n.d.).

*Implementation*: the definition used here, specific to educational technology, is that implementation is “measured as the fidelity with which Technology Immersion components and related elements attain an envisioned ‘ideal’” (Shapley et al., 2009, p. 18).

*Information and Communications Technology (ICT)*: digital devices, including the hardware and software especially deployed in an educational context (Berger-Tikochinski et al., 2016, p. 170).

*No Child Left Behind Act of 2001 (NCLB)*: Landmark education law passed by U.S. Congress establishing requirements for state-specific, standardized testing and accompanying annual, learning progress goals. This law also mandated school quality reports that indicated teacher quality and schools’ performance data (No Child Left Behind Act, 2001).

*One Laptop per Child Initiative (OLPC)*: A Massachusetts Institute of Technology (MIT) initiative, announced in 2005 and subsequently commencing in 2007, that focused on designing and deploying low-cost laptops to poor countries and regions (Inter-American Development Bank, Department of Research and Chief Economist, 2012, p. 6).

*Pedagogy*: Watkins and Mortimer (1999) defined pedagogy as “any conscious activity by one person designed to enhance learning in another” (p. 3).

*Standards-Based*: education programs, curricula, processes, and systems in which “learning standards [...] determine the goals of a lesson or course, and teachers then determine how and what to teach students so they achieve the learning expectations described in the standards” (Partnership, 2013).

*Technological Pedagogical Content Knowledge (TPACK)*: conceptual framework for understanding the role that technology plays in educational contexts. Mishra & Koehler (2006) proposed that this framework

is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (p. 1029)

*Technology Immersion*: Conditions devised in 2003 by the Texas Education Agency (TEA) to streamline conditions for potential vendors interested in providing devices and support for the upcoming Texas Immersion Pilot (TIP),

- A wireless mobile computing device for each educator and student on an immersed campus to ensure on-demand access to technology;
- Productivity, communication, and presentation software for use as learning tools;
- Online instructional resources that support the state curriculum in English language arts, mathematics, science, and social studies;
- Online assessment tools to diagnose students’ strengths and weaknesses or to assess their progress in mastery of the core curriculum;

- Professional development for teachers to help them integrate technology into teaching, learning, and the curriculum; and
- Initial and ongoing technical support for all parts of the package. (Shapley et al., 2009, p. 17)

*Transforming American Education: Learning Powered by Technology; the 2010 National Educational Technology Plan (NETP)*: the 2010 edition of a report compiled as required by the U.S. Department of Education's Office of Educational Technology that set ambitious goals for integrating educational technology into the U.S. K–12 education landscape. The 2010 NETP acknowledged that since technology plays a critical role in people's lives outside education, its capabilities need to be leveraged within education as well (U.S. Department of Education, 2010).

### *Conclusion*

Missing from the critical discussion of the 1:1 model is how students' and teachers' social experiences are affected when all parties have consistent and, inevitably, expected access to personal computers at school, at home, and those places in between. Qualitative factors (e.g., students' and teachers' perceptions, concerns, use patterns) within the literature merit further exploration within studies that holistically depict how 1:1 programs affect schools' principal constituents. Further studies would allow for more focused research on subgroups and critical stakeholders, as 1:1 initiatives are increasingly popular for ensuring students' and teachers' access to internet-connected education in the United States (Bebell & Kay, 2010; Detering, 2017; Donovan et al., 2007; Dudley, 2018; Muniz, 2018). Per socioeconomic status, per grade level, per ability level, and per discipline, determining how or if the 1:1 model improves equity, access, personal

satisfaction, engagement, and other metrics must be made clearer through more research (Sauers & McLeod, 2018, p. 906).

Understanding stakeholders' perceptions of teaching and learning in 1:1 programs is valuable for determining the effects for those participating in these initiatives (Jacob, 2020, p. 177). There are established links between implemented 1:1 programs and pedagogical adaptations for teachers (Donovan et al., 2007; Penuel, 2006; Sauers & McLeod, 2018). At the same time, exploring how 1:1 programs challenge teachers' paradigms calls these links into question (Gherardi, 2017; Hallman, 2019; Tallvid, 2016; Windschitl & Sahl, 2002). Amplifying educators' voices helps researchers to better understand 1:1 education.

## CHAPTER TWO

### Literature Review

#### *Introduction*

One-to-one (1:1) laptop initiatives continue to proliferate in American public schools, yet there remains a lack of research consensus as to what, specifically, these devices offer to the educational process (Bebell & Kay, 2010, p. 6; Mouza, 2008, p. 469; Sauers & McLeod, 2018; Warschauer et al., 2014; Zheng et al., 2016). Further, there is little research on the effects that these programs have on teachers' and students' wellbeing (Sauers & McLeod, 2018). Nonetheless, the widespread adoption of the 1:1 model continues.

This chapter reviews existing research on 1:1 initiatives. It begins with an examination of public sector interests that pushed to include computers in the instructional process. In doing so, this literature review situates the 1:1 model among landmark American political and educational publications that include educational technology components. This chapter then examines private sector initiatives that centralize computers within American K–12 education. Reviews of the literature focus on the first two large-scale, statewide 1:1 initiatives follow the preceding analyses. These two states laid the groundwork for the modern 1:1 model, as these initiatives serve—by virtue of their significant government funding and planning alongside contemporaneous research studies—as early acknowledgments of the 1:1 model's transformative potential.

Following these analyses, this chapter reviews existing research analyses and meta-analyses that focused on 1:1 initiatives. The chapter continues with an analysis of

schools' and districts' 1:1 implementation considerations. These considerations are as follows: equity and access, scope and scale, standardized test scores, and fiscal considerations.

This chapter then examines the experiences of those working and learning in 1:1 schools: teachers, administrators, and students. Using TPACK (Mishra & Koehler, 2006) and CBAM (Hall et al., 1973) conceptual frameworks, this portion of the chapter acknowledges the nature of participants' felt changes in 1:1 models. Within the TPACK framework, the laptops at the center of the 1:1 model challenge and adapt teachers' existing ideas of pedagogy and learning. Within the CBAM framework, the laptops are disrupters: contextual change agents that educational professionals disparately process over time. Finally, this chapter finishes with conclusions drawn from the literature review.

### *Public Sector Educational Technology Initiatives*

This section examines how public sector efforts to implement computers in American K–12 education inform contemporary 1:1 initiatives. Beginning with the publication of *A Nation at Risk* in 1983 and concluding with an examination of the *National Educational Technology Plan* in 2010, this section details how notable education publications and laws solidify the U.S. Government's role as a proponent of increased educational technology. Over the course of 27 years, technology's role transforms. Educational technology grows from an ancillary component to be considered amongst wider U.S. Government concerns regarding U.S. students' international competitiveness, to a means by which schools may hold their stakeholders accountable through increased equity and access. Finally, educational technology becomes an

essential component for both students and teachers as a dynamic job market, requiring technology competency, emerges.

### *1983: A Nation At Risk*

There are litanies of worthy starting points for any examination of computers within American education reform, but the 1983 publication of *A Nation At Risk* (Gardner et al., 1983) aptly serves as a critical moment to begin. This report was a catalyst for the general, modern urgency to enact meaningful change within America's K–12 public schools, and its publication initiated both the eagerness and the rationale(s) with which policymakers have integrated computers into the American classroom.

The legacy of *A Nation At Risk* is multifaceted. Its origins, release, and ensuing popularity are subject to years of critique. According to its introduction, *A Nation At Risk* was published after then-U. S. Secretary of Education, T. H. Bell warned readers that “widespread public perception that something is seriously remiss in our educational system” (Gardner et al., 1983, p. 9). It is a testament to the U.S. public education system's glaring identity crisis at the start of the 1980s that such a report was commissioned following the U.S. Education Secretary's assessment of public perception. By a second interpretation, *A Nation At Risk* was an alarmist reaction to emerging nations' (e.g., China's, the Soviet Union's) ascents to legitimacy, parity, and supremacy in educational comparisons to the United States.

These interpretations, though, are not mutually exclusive; taken together, they offer valuable context for understanding how and why the computer made schools' stakeholders ask then, as they ask now: what is the purpose of school? Gardner et al. (1983) argued that “our society and its educational institutions seem to have lost sight of

the basic purposes of schooling, and of the high expectations and disciplined effort needed to attain them” (p. 13). That conclusion attributed other countries’ advancements in manufacturing to this loss of focus, suggesting that these outcomes are only a few of many indicators that American education was failing on a large scale.

Embedded within this alleged failure were acknowledgments that, even in the early 1980s, computer skills held value. Additionally, these acknowledgments suggested American education was devoid of a coherent program for educating students accordingly. Gardner et al. (1983) noted that “computers and computer-controlled equipment are penetrating every aspect of our lives, homes, factories, and offices” (p. 18) and in order to address this new reality (and others), there must be a curricular shift. This shift—dubbed “New Basics” (p. 34)—aimed to address “personal, educational, and occupational goals” (p. 34) in addition to the existing school curriculum. This shift also marked a general expansion of the school’s role in preparing students for life after the conclusion of their K–12 experiences.

Computers’ new role in this curricular structure existed within “New Basics,” a new and more rigorous list of high school graduation requirements. The five New Basics consisted of four years of English, three years of mathematics, three years of science, three years of social studies, and a half-year of computer science classes (Gardner et al., 1983, p. 32). The provision for computer science education was so that high school students may “(a) understand the computer as an information, computation, and communication device; (b) use the computer in the study of the other Basics and for personal and work-related purposes; and (c) understand the world of computers [...]” (p. 34). These proposed, prospective understandings proved prescient given the

technological inundation of contemporary American life, but these understandings remain as daunting now as they were then. While the authors of *A Nation At Risk* could not have conceived how woven into the fabric of American (and global) life computers would become, the authors recognized the growing, educational importance of these devices.

Still, in 1983 and in the years that followed, advancements in technology moved more quickly than advancements in education policy. The ensuing drive to purchase the “right” computers, the drive to both build and maintain computers’ accompanying infrastructure responsibly, the drive to adequately train teachers to deploy and teach necessary computer skills effectively, and the drive to equip students with the most essential skills remain active debates at nearly every level and scale of implementation in contemporary contexts. By virtue of modern laptop computers’ essentialization in American education at large, these implementation considerations are particularly evident in 1:1 programs.

#### *No Child Left Behind Act of 2001*

Eighteen years after the publication of *A Nation At Risk*, U.S. Congress’s passage of the No Child Left Behind Act (NCLB) further codified federal involvement in public education, and it further calcified computers’ positions in American K–12 education. NCLB signed into law the mandate for school districts to actively engage educational technology for the benefit of both teachers and students (U.S. DOE, 2011). In 2002, the U.S. Department of Education Office of the Under Secretary released *No Child Left Behind: A Desktop Reference* (Ohnemus, 2002) to serve as a reference for explaining these changes; this guide illustrated those statistics and concerns that informed the

legislation as well as how NCLB aimed to address perceived inadequacies in the public education system's deployment of computers and educational technology as a whole.

While NCLB addressed some of the same concerns as *A Nation At Risk*, NCLB also introduced others: namely, the critical notions of equity and access. *No Child Left Behind: A Desktop Reference* noted that,

according to the National Center for Education Statistics, in 2000, while the overall ratio of students-to-instructional computers with Internet access was 7-to-1, in high-poverty schools the ratio was 9-to-1 compared to 6-to-1 in low-poverty schools. Similarly, in 2000, 60 percent of classrooms in high-poverty schools were connected to the Internet compared to 82 percent of classrooms in other schools. (Ohnemus, 2002, p. 85)

This list highlighted a need to focus not simply on computer literacy, but on equitable access to internet-connected computers. NCLB aimed to remedy the inequities that its quoted statistics highlight by deploying an “Educational Technology State Grants Program,” the goal of which was to distribute funds—particularly to poor students—that would serve “to improve student academic achievement through the use of technology in elementary and secondary schools” (p. 85). In addition, these grants were deployed with emphases on teacher training through effective professional development (p. 85). School districts were quick to react to these new programs (and others) within NCLB, and by 2003–2004, 1:1 initiatives in which each student had access to personal internet-connected devices were underway. Bebell and Kay (2010) wrote that “it was estimated that 4% of the nation’s school districts were implementing some form of 1:1 computing” (p. 6). In 2006, only two years later, estimates rose to 25% (p. 6).

*2010: The Common Core State Standards*

Where NCLB mandated a standardized testing regimen in 2001, the publication and subsequent adoption of the Common Core State Standards (CCSS) in 2010 makes note of 21<sup>st</sup>-century skills—those understandings, abilities, and competencies that the new century necessitated. These 21<sup>st</sup>-century skills consider the computer’s new centrality to American life. CCSS developers note within their introduction to the document that “[a] particular standard was included in the document only when the best available evidence indicated that its mastery was essential for college and career readiness in a twenty-first-century, globally competitive society” (National Governors Association Center for Best Practices; Council of Chief State School Officers, 2010). This inclusion acknowledges concerns NCLB outlined by delineating explicit skills to be learned and taught in school. These skills more sharply focused the educational narrative toward the next century: one in which the skills outlined within CCSS are practiced more frequently on a digital plane.

These emphases on 21<sup>st</sup>-century skills encouraged the 1:1 model. In order to assess the skills that CCSS outlines, the U.S. Department of Education “awarded two groups of states grants to develop a new generation of tests [...] aligned to the [CCSS] and have been adopted by 36 states” (U.S. Secretary of Education Press Office, 2010). Given the CCSS emphases on both information literacy and contextual understandings, these assessments further pushed U.S. education to include digital skills. These digital skills were intended for students’ computers.

*Transforming American Education: Learning Powered by Technology, the 2010 National Education Technology Plan*

The 2010 edition of the National Education Technology Plan (NETP) laid out President Barack Obama's Administration's vision of educational technology, and, thus, the extent to which computers ought to permeate schools' classrooms. Some extra emphasis in this section is devoted to the 2010 NETP because it informs much of the contemporary push to implement 1:1 programs. The NETP is regularly revised and rewritten to reflect the turbulence of its area of focus, and it is generally published (at least) every five years, functioning, as described on the U.S. Department of Education's Office of Educational Technology's website, as "the flagship educational technology policy document for the United States" ("National Education Technology Plan," n.d.). The 2010 edition of the NETP outlined, broadly speaking, the increasing centrality of computers in public education, and it serves as an indicator of policymakers' goals and ambitions nearly a decade ago.

The 2010 NETP weighs significantly on the current state of computers in American education in that it links general, technological implementation to positive educational outcomes. In the plan, the authors outline two primary goals to be fulfilled by the year 2020. Notably, these goals are not, in and of themselves, dependent solely upon the integration of educational technologies. The first of these goals, calling for a raise in "the proportion of college graduates from where it now stands [39%] so that 60% of our population holds a 2-year or 4-year degree" (U.S. Department of Education, 2010, p. v) links—via the sentiment's primacy and inclusion in a document such as NETP—a decidedly educational (as opposed a strictly technology-driven) outcome to a successful, technological implementation.

The second of these primary goals is noteworthy because it builds on the earlier equity and access objectives embedded in the George W. Bush Administration's NCLB Act by aiming to “close the achievement gap so that all students—regardless of race, income, or neighborhood—graduate from high school ready to succeed in college and careers” (U.S. Department of Education, 2010, p. v). Rhetorically and ideologically aligning educational technology's role this way marks a distinct shift from what were merely ambitions of equity toward essentializing educational technology as a means for attaining both academic and post-secondary success.

The 2010 NETP authors acknowledged the ambitious nature of the plan's admirable goals. At the same time, achieving these goals by way of “prompt implementation” raises fundamental concerns. These concerns foreshadow problems within modern 1:1 initiatives. The means (by which these goals were to be reached) may have been undermined by urgency. It is problematic, for instance, to be “strategic and coherent” (U.S. Department of Education, 2010, p. v) in one's “investments” (p. v) while also “prompt” (p. v) in one's implementation of a given policy. This possible contradiction in motive can, likewise, undermine 1:1 education policies: before local policymakers can ensure that best practices are “brought to scale,” they must know—concretely—what the authors describe as “the programs and projects that work” (p. v). This conflict, between strategy and expedience, has manifested in applications of educational technology (including 1:1 programs) that lack broad and aforementioned research-based consensus.

Perhaps a more troublesome suggestion, and certainly a more consistent one—present to some extent from *A Nation At Risk* in 1983 to the 2010 NETP—is the

perceived link between the technological successes of private enterprise and the need to emulate these successes in the public education sphere. Just as *A Nation At Risk*, in part, squared the perceived, global marginalization of the United States as the byproduct of the country's allegedly failing school systems, the 2010 NETP framed the necessity for students to master 21st-century competencies—"critical thinking, complex problem solving, collaboration, and multimedia communication" (U.S. Department of Education, 2010, p. vii)—by emphasizing schools' untapped potential for preparing students for the workforce.

Though few would dispute that the 2010 NETP (U.S. Department of Education, 2010) correctly predicted, "technology-based learning and assessment systems will be pivotal in improving student learning and generating data that can be used to continuously improve the education system at all levels" (p. v), perhaps equally few would likely dispute the fact that public education has largely trusted private corporations with the enormous troves of data generated by such learning and assessment systems. These conflicts—between swift implementation and thorough research review, between public education and private sector interests—acutely impact 1:1 initiatives' fidelity.

The 2010 NETP (U.S. Department of Education, 2010) indicated the scope and scale of the federal government's ambitions in this regard by marking the following five-year goal: "All learners will have engaging and empowering learning experiences both in and outside of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society" (p. xii). In order to reach this goal, the NETP included several recommendations.

Among the 2010 NETP recommendations that foretell the ensuing popularity of the 1:1 model are the need to “ensure that students and educators have adequate broadband access to the Internet and adequate wireless connectivity both inside and outside school” (U.S. Department of Education, 2010, p. xiii) and the need to “ensure that every student and educator has at least one Internet access device and software and resources for research, communication, multimedia content creation, and collaboration for use in and out of school” (p. xiii). Since the 2010 NETP’s publication, and arguably, irrespective of its stated aims, teachers have used computers in classrooms across this country to engage their students in learning. Consequently, these same teachers have also sought to learn how these devices augment, extend, or replace existing instructional methods (Whicker, 2012, p. 141). Both the Common Core State Standards (National Governors Association Center for Best Practices; Council of Chief State School Officers, 2010) and the 2010 NETP mandated some degree of computer literacy. After these publications, teachers had a tangible incentive for not only including computers within their classrooms but also essentializing internet-connected devices as fundamental tools to engage and assess students’ learning.

### *Conclusion*

One-to-one initiatives are neither a new trend nor a phenomenon that coalesced in a vacuum: public sector support for educational technology spans decades. Though private-sector companies have heavily invested in educational technology for decades as well, these corporations have done so with institutional guidance and encouragement from the U.S. Government, state agencies, and local districts. This guidance is written into government documents offering formal guidance, excitement for the future, or

warnings for how United States students may fall behind other countries. Today's 1:1 programs can trace their roots through each of these.

### *Private Sector Educational Technology Initiatives*

The following section contextualizes the preceding review of landmark public sector interests in educational technology with an additional review of private companies' interests in computers' deployment within American K–12 schools. As is the case for the preceding section, the following section should by no means be considered comprehensive. The companies' efforts mentioned in this literature review—Apple, Google, and Microsoft—are highlighted in part for their preeminence and ongoing influence in contemporary, American K–12 education. Also, their inclusion should not be understood as either an endorsement or as a complete summation of their endeavors in the field of educational technology. While the following analyses are not focused strictly on 1:1 device deployment, the following examinations of these companies' interests serve as a necessary context for the computer's role in a 1:1 paradigm because they situate 1:1 programs within a longer history of educational technology as advanced by diverse groups and interests.

For chronological and contextual purposes, the following section begins—two years removed from 1983's *A Nation At Risk*—in 1985 with the onset of the *Apple Classrooms of Tomorrow* (Dwyer et al., 1990) research initiative. This point in time is roughly contemporaneous with that of the previous section's public sector analysis, and this section continues with an examination of Microsoft's *Anytime Anywhere Learning* initiative and finishes with Google's ongoing involvement in education via the

proliferation of that company's *Chromebook* laptop and *Google Apps for Education* cloud-based software suite.

### *Apple Classrooms of Tomorrow*

One of the first—and certainly one of the most influential—private-sector examinations of the intersection between computers and education is the Apple initiative known as Apple Classrooms of Tomorrow (ACOT). Beginning in 1985, Apple partnered with researchers, public schools, and colleges in order to conduct extended research on the ways that computers can transform education (Dwyer et al., 1990). The company installed computers, the requisite infrastructure, furniture to accommodate the hardware, as well as accompanying software, and observed how the new technologies impacted the instructional process.

While there have been substantial changes to computers, networking, and educational technologies since ACOT, one of the initiative's most pivotal findings was its characterization of the earliest stages of the project. Dwyer et al. (1990) observed that “although the sheer number of computers in ACOT classrooms radically transformed the physical environment, for the most part, student learning tasks remained unchanged. Gradually, however, new patterns of teaching and learning emerged at all sites” (p. 4). This sheds an early, important light on the importance of ongoing, constructive, high-quality professional development in the successful implementation of computers in the classroom. This finding informed the framing of what Apple called, “the stages of evolution in its classrooms: Entry, Adoption, Adaptation, Appropriation, and Invention” (p. 4). Interestingly, this model closely foreshadows Puentedura's (2009) Substitution, Augmentation, Modification, and Redefinition (SAMR) model of technology integration.

*Microsoft: Anytime Anywhere Learning*

While Apple pioneered private companies' interests in the early potential of computers within K–12 education, Microsoft continued this evolution with their examination of the 1:1 device deployment model in the *Anytime Anywhere Learning* initiative. In 1996, in collaboration with Toshiba America Information Systems, Microsoft implemented an early initiative that manifested in 1:1 device distribution in some of the 55 participating schools in the United States (Healey, 1999). This initiative combined Microsoft's productivity software with Toshiba's *notebooks* (i.e. laptop computers) to enhance students' learning and teachers' pedagogy. In these contexts, which by 1999 had grown to include “nearly 50,000 students and teacher participants in more than 500 public and private schools” (Healey, 1999, p. 17), participating stakeholders confronted two of the factors that influenced 1:1 initiatives at the turn of the century: equity and access. Given that these devices and their software were meant to be used by middle school students, questions naturally arose regarding how much, how often, and in what contexts students ought to utilize these devices. For varying reasons, some districts opted to use these laptops in 1:1 contexts, while others utilized rental carts to store limited numbers of computers in school (Healey, 1999). Tellingly, NCLB came to regard concepts of equity and access as critical to educational technology just a few years later, in 2003.

### *Google Apps for Education and Chromebooks*

Beginning in 2006, Google initiated efforts to move into the educational technology fold in earnest. With the deployment of Google Apps for Education (GAFE, later known as G Suite for Education), the company combined hardware with its software purposefully focused on educational contexts. In fewer than 20 years, the proliferation of both Chromebooks and G Suite software in K–12 education has been dramatic.

According to Google, by 2019, “there are 80 million educators and students around the world using what has become G Suite for Education. [...] 30 million more use Chromebooks [...] inside and outside the classroom” (Vamvakatis, 2019). At the same time, despite the massive educational technology investment that this represents in what are increasingly 1:1 educational contexts, stakeholders have diverse concerns about the use of a single company’s hardware and software in such wide applications.

Among these aforementioned concerns are those of stakeholders’ privacy. Some of the most pressing ethical questions presented by the private sector’s investment in educational technology are those that concern users’ data. While the advent of companies charging little to no fees for use of their software in exchange for users’ data is not new, the prospect of this practice’s normalization in public education is. Google Apps for Education (GAFE), Google’s cloud-based suite of software programs, is of the most popular digital services at the heart of this dilemma, as it offers what Lindh and Nolin (2016) describe as a “technological layer between and around pupils and teachers” (p. 645). Since GAFE is not restricted to Google’s Chromebook laptop computers, it has become a preeminent replacement for often sizable, on-site, location-based storage

servers, as well as a desirable replacement for traditional software programs for composition, data organization, and presentation design (p. 645).

The usefulness of the software included within GAFE is self-evident, as the GAFE suite is widely used in public schools. The extent to which users potentially surrender their privacy while using GAFE is not clear. Privacy concerns are underscored by the fact that GAFE users are, in the case of schools, children or public employees. In a 2016 study investigating Google's privacy policies within GAFE, Lindh and Nolin found that "Google also has an interest in continuously processing user data in order to refine their algorithmic identities, which become valuable intellectual properties owned by Google to be utilised commercially but not sold to third parties" (p. 658). Google advertises and sells its low-cost Chromebook laptops especially for educational implementations in 1:1 initiatives. Since these machines run, exclusively, GAFE programs, there is some cause for concern. To be clear, though, this practice is neither exclusive to Google, nor does Google seem to obfuscate these realities.

### *Conclusion*

Private-sector educational technology initiatives are not limited to those currently proliferating. Corporations have long sought to engage students and teachers with their products, often with the help of the public sector. While the companies' efforts here only represent a few of the many corporations who have invested in educational technology, both their notability and their inclusion in this literature review are derived from the scale of their interests in students' and teachers' computer use in school. These efforts evolved into modern, popular 1:1 programs. Now, as device prices fall, and as users' lives become

more enmeshed with their devices, private-sector companies must weigh the benefits that their products provide against mounting privacy concerns.

### *Two Statewide 1:1 Initiatives*

The following section highlights the first two 1:1 initiatives in the United States to be initiated by state-level actors: Maine and Texas. As these states' experiences frequently appear in existing research into 1:1 studies, the following section includes an overview of their contexts, implementation stages, issues in determining successes, and their costs. These indices appear because of their prevalence and relevance in evaluating 1:1 programs at nearly all levels.

#### *Maine*

The first deployment of a 1:1 model on a statewide scale within the United States was the Maine Learning Technology Initiative (MLTI) in 2002 (Lane, 2003). In retrospect, early 1:1 device distribution programs seemed nearly utopian in their promise: laptop computers—once powerful but prohibitively expensive devices reserved for only the most privileged consumers—would effectively enter into the masses' common routines, as they are given by schools to their students, regardless of their circumstances. With funding from the State of Maine itself, via the establishment of the Maine Learning and Technology Endowment (MLTE) in 2001 with considerable and additional funding provided by the Bill & Melinda Gates Foundation (Abell Foundation [AF], 2008, p. 1), the commencement of the MLTI marked the first time that an entire state proposed such a radical apportionment of powerful technology in the form of a 1:1 initiative.

The MLTI's implementation plan transpired in several stages, from localized and controlled deployment to more sophisticated, sustainable educator development on a

statewide level. An early 2002 pilot program offered professional development for teachers as laptops were distributed to students and teachers in a handful of schools (Sargent, 2003, pp. 3-4) before the MLTI began in earnest. In the fall of 2002, the laptops were allotted to seventh graders in 240 schools across the State of Maine (p. 4). After the large-scale distribution, each participating school nominated a teacher to receive professional development training in order to continue the successful implementation of the MLTI (p. 4). Following the creation of an additional, regional leadership position for selected teachers to foster statewide professional development, administrative roles were crafted to address the instructional design and delivery of content within the MLTI (p. 4).

Determining the success of the MLTI (and subsequent, large-scale 1:1 initiatives) is difficult to do in an objective, extrapolative context. This is, in part, due to the disparate effects incurred by stakeholders at different points within the implementation. Early evaluations of the MLTI, for instance, indicated that teachers felt positively about the laptops, but that their uses of the computers in the first few months of the initiative “merely scratch the surface of the possibilities for this technology” (Sargent, 2003, p. 7). A survey conducted in December of 2002 indicated that teachers were utilizing the laptops a few times a week, or more, most often for communicating with colleagues and instructional development (p. 7). Whether these findings are to be determined as successes, significant developments, or failures depends on the indices by which evaluators are measuring.

By 2011, teachers in MLTI schools demonstrated increased synthesis of devices into their professional practice. A report from the Maine Education Policy Research Institute indicated that “approximately 80–90% of the teachers reported using their

laptops a few times a week or more frequently to develop instructional materials, and conduct research for lesson development” (Silvernail et al., 2011, p. 5). Still, there remained room for improvement. While there was substantial development over the intervening eight years with regard to the utilization of the laptops for classroom instruction itself (Silvernail et al., 2011, p. 5), by 2011 there was an expectation that the laptops’ propensity for differentiation would be more widely advantaged (p. 5).

As a state-run, *one laptop per child* program, the MLTI aimed to effect educational change. The MLTI was also an important study for fiscal implications. Importantly, Maine’s educational technology landscape at the beginning of the MLTI’s implementation was, like much of the United States at the beginning of the 21<sup>st</sup> century, in a locally variable and generally nascent stage. With this context in mind, the MLTE’s aim was humble: “the goal of the MLTE is to ensure a necessary level of access to technology, the Internet, and training and learning opportunities for all Maine public schools, students and teachers at the middle school and high school levels” (McCarthy & Breen, 2001, p. vi)—when compared with the transformative standards to which some observers hold contemporary 1:1 programs, the MLTE’s means by which the State of Maine expected to achieve their stated goal was via the MLTE’s “primary component [...] the purchase of computer devices and a basic software package for every student and teacher in the designated grade levels” (McCarthy & Breen, 2001, p. vii).

This mechanism for purchasing hardware and software packages, for fusing technology, teaching, and learning, predated the cloud storage era. As might be expected for such a large endeavor, some schools within this initiative seem to fare better than others over time, but the cumulative results of the program—on both

quantitative and qualitative indices—were middling, by some accounts (Weston & Bain, 2010, p. 6). This is perhaps more problematic when the results of the MLTI are considered against the costs incurred by the MLTE.

Maine’s first-of-its-kind, expansive foray into statewide 1:1 student-to-device implementation is a valuable benchmark, in part, because of how the study juxtaposes educational technology costs weighed alongside student and teacher performance factors. Considering the massive \$50,000,000 investment (McCarthy & Breen, 2001, p. 17) appropriated for the MLTE, the scholastic measurables generated by students and teachers were positioned against the backdrop of these fiscal realities. In their final report on the initiative, McCarthy and Breen (2001) recorded six findings outlining recommendations and best practices for sustainably maintaining both the technology and funds within the MLTE (p. 18). Today, nearly 20 years after the MLTE final report, the projected concerns within these findings—those regarding pedagogy, instructional design, resource allocation and distribution, and relevant fiscal considerations—remain akin to those concerns expressed by contemporary, public jurisdictions implementing 1:1 programs for their stakeholders.

### *Texas*

Within only a few years of the Maine Learning Technology Initiative (MLTI) implementation, the State of Texas endeavored to carry out its own 1:1 initiative: the Technology Immersion Pilot (TIP). Conceived in the Texas Legislature in 2003 as a large-scale pilot program, the TIP supposed that technological immersion was a superior means by which Texas schools could improve educational technology use (Shapley et al., 2009, p. i).

In contrast to the MLTI, the TIP worked from a focused, needs-based approach. To that end, the TIP selected eligible schools according to demographic criteria. Schools eligible to apply for participation in the program were limited to those eligible for “Title II, Part D funds (i.e., high-need due to children from families with incomes below the poverty line, schools identified for improvement, or schools with substantial need for technology)” (Shapley et al., 2009, p. 5).

The TIP structured, monitored, and implemented a quasi-experimental design that focused on 42 participating schools across the state of Texas, with students and teachers in 21 of these schools receiving monies for participation in the study, laptops, professional development, and educational resources as a *treatment* group (Shapley et al., 2009, p. 5). The *control* group consisted of schools that closely matched the predetermined factors of the treatment group. Educators in these schools received monies for participation in the study, they received professional development and planning resources for forthcoming technology immersion in the final years of the study, and some participating teachers within the control group were provided with laptops (pp. 5-6).

The TIP’s major findings from its fourth and final year of implementation varied widely across the specified variables and domains within its accompanying, summative study. While some of these findings suggest finite improvements, others beg more questions than provide answers for how early state-driven, 1:1 initiatives impact schools. Of note within *immersion* schools was the demonstrable growth in utilizing the laptops and resources as well as considerable growth in teachers’ adoption of technology for the purpose of student learning (Shapley et al., 2009, p. 80). In terms of outcomes for students, the fact that “evidence from classroom observations suggested that laptop

computers and digital resources allowed students in Technology Immersion schools to experience somewhat more intellectually demanding work” (p. 81) suggests a level of delivery on the promise that 1:1 initiatives hold.

Some of the findings within the TIP evaluation report suggested that 1:1 initiatives can usher in more complex changes. For teacher participants in the TIP, educators’ readiness for the laptops’ deployment (Shapley et al., 2009, p. 88), their changing perceptions of a school’s culture in the midst of the initiative (p. 81), their willingness to remain employed in a technologically immersive school (p. 89), along with their disparate deployment of the technologies en route to disparate levels of immersion (p. 88) all point to underlying and multifaceted dynamics related to how 1:1, immersive schools change the nature of teachers’ work.

The TIP suggested the existence of equally complex changes for the students themselves. Findings regarding students’ varying levels of use both in and out of school (Shapley et al., 2009, pp. 86-88), the erratic effects that the laptops had on students’ test scores and achievement metrics (pp. 84-88), as well as the “significantly lower attendance rates” (p. 84) experienced by treatment schools in the first three years of the study pointed toward more esoteric, less well-understood changes for students in these technologically immersive schools.

At the end of the pilot program, questions as to the viability of such a large-scale, immersive, 1:1 model remained. Stakeholders expressed varying concerns as to how, if, or under what circumstances the 1:1 technology immersion could continue past the conclusion of the study (Shapley et al., 2009, p. 90). Where the MLTI (which included a much smaller, much more concentrated pilot program) accompanied the creation of the

MLTE to manage funds in an ongoing and statewide capacity, the TIP's conclusion left local school leaders without a cohesive notion of how to move forward. Pointedly, funding concerns underscored the initiative's viability (p. 89-90). In addition to commentaries related to the availability of assorted grants, local funding opportunities, or proposed appropriations under consideration for participating schools as means by which schools' technology immersion may continue, the stakeholders' opinions included within the TIP's summative report also tied the sustainability of their 1:1 environment to "educators' beliefs about technology's value for addressing the learning styles and needs of students, and educators' commitment to move toward digital school environments" (p. 91). This sentiment, taken alongside the uneven and often localized outcomes for schools participating in TIP, suggests that while ample funding is a primary consideration in the viability of statewide 1:1 programs, the cultural changes inherent within a 1:1, technologically immersive environment are worthy of thorough consideration.

### *Conclusion*

In both Maine and Texas, the state governments implementing 1:1 initiatives had to solve critical problems at nearly every juncture of each state's program. Structural considerations regarding vendors' pricing, funding models, deployment timelines, accompanying research studies, and how much control to allot to local districts proved widely variable across both studies. While both states were early 1:1 adopters, the research studies that accompanied these initiatives—both those commissioned by the states and others—highlight just how difficult it is to change education in such a profound way in such a short amount of time.

### *Research Syntheses and Meta-Analyses*

One area of consistent agreement within 1:1 research is persistent discontent with the quality and generalizability of existing research. Since the first implementations of 1:1 initiatives, there has been incongruency: a slow trickle of high-quality, generalizable research concurrent with 1:1 studies' proliferation at a blistering pace. Penuel (2001; 2006) expressed this concern as early as 2001. In a formative, early synthesis of 1:1 research, Penuel (2006) observed that in spite of “hundreds” of “large-scale projects that provide one-to-one, 24/7 access to computers in the Internet,” educational technology research has not adequately kept pace (p. 329). Within this same research synthesis, Penuel (2006) also concluded that—citing an earlier, 2001 review Penuel co-authored—there were too few research-based studies (and persistent weaknesses within these studies) to meaningfully ascertain the merits of 1:1 studies (p. 329).

In 2006, market and technology considerations regarding availability, affordability, and viability of high-speed internet access and affordable, scalable hardware products make Penuel's (2006) research synthesis a useful launch point for any literature review focused on 1:1 studies. This research synthesis is especially useful for this research study, though, because its constraints are similar to those within this dissertation's focus: then-existent research of those 1:1 initiatives that utilized internet-connected laptops within K–12 contexts. Notably, Penuel (2006) fundamentally distinguishes these conditions from earlier research syntheses that outlined initiatives that sought to provide the student with nonportable desktop computers (p. 331).

Over a decade later, in 2016—an intervening span that, for the sake of topical and contextual significance, included the inaugural release of the iPhone in 2007 and Facebook's initial public offering in 2012—Zheng et al. (2016) conducted the *first* meta-

analysis on the findings of 1:1 studies (p. 1054). This meta-analysis concluded with acknowledgments that 1:1 initiatives are likely to further grow, and there remains a need for further, high-quality, generalizable research (p. 1076). This discrepancy between applicable research availability and initiative implementation has continued to concern researchers who have synthesized and analyzed research on 1:1 studies in the years since Penuel's (2006) report (Abell Foundation, 2008, p. 17; Bebell & Kay, 2010, p. 6; Bebell & O'Dwyer, 2010, pp. 12-13; Zheng et al., 2016).

This literature, then, serves only as the latest of many attempts to wrangle a central problem constraining this research area: to craft meaningful parameters for even reviewing 1:1 studies remains a difficult task. It is reasonable to attribute at least some of this difficulty to the nature of internet technology itself. Today, more than 20 years removed from the turn of the century, and in the midst of the high-speed, mobile internet age, when one considers Penuel's (2006) suggestion that "the educational technology research community's collective knowledge about one-to-one initiatives has not to date kept up with the rapid expansion of these initiatives or with their breadth" (p. 329), he or she may still read this description as apt for contemporary 1:1 research studies.

Again, contemporaneously, 1:1 research eschews categorical identification. It is difficult to determine just how beneficial *any* 1:1 student-to-device deployment model is for its respective stakeholders (Bebell & Kay, 2010, p. 6; Mouza, 2008, p. 469). Also, despite the sentiment expressed within the previous sentence, researchers continue to author dissertations, articles, papers, and reports that contain findings suggesting, in various capacities, *some* level of meaningful change to both the instructional and learning processes (Penuel, 2006, p. 336). In their meta-analysis of available research on 1:1

laptop environments, Zheng, Warschauer, Lin, and Chang (2016) addressed the lack of clarity when it comes to regarding the findings within 1:1 studies, noting that their meta-analysis was the first published on the topic (p. 1054). Nonetheless, assuming—by virtue of the sheer amount, depth, and breadth of existent 1:1 studies released over the past 20 years—meaningful findings are within these studies, it remains difficult to determine the *extent* to which these findings are generalizable and, thus, *meaningful*.

In addition to the previously expressed difficulties regarding 1:1 studies' generalizability, it is similarly and somewhat maddeningly difficult to determine just how many 1:1 student-to-device initiatives, one-to-one programs, learning technology deployment models, educational technology immersion plans, or digitally immersive structures (among other monikers) exist at any given moment. Counting how many 1:1 student-to-device models currently exist, though, is not easy.

It is worth examining, first, whether or not it is essential to know how many exist in the world. For example, though 1:1 initiatives exist internationally, discerning which (if any) cultural and linguistic barriers prohibit or amplify meaningful research comparisons between countries affects the researcher's methodology. When comparing initiatives within the same country, determining who and what to count as relevant for 1:1 research is no clearer: is a private or charter school's implementation fundamentally distinct from that of a public school? How applicable are the findings of a 1:1 study focused on a rural Wyoming elementary school to a proposed 1:1 implementation within a Los Angeles community college? Before one endeavors to count those applications, research sources, initiatives, and implementations, these questions must be answered.

This lack of clarity in enumeration, nomenclature, and relevance can, in part, be attributed to the aforementioned equivocation of terms used—with varying degrees of coextension—to describe phenomena that (loosely and perhaps informally) amount to the existence of individualized, internet-connected computers provided to students at little or no cost by an organization that has a vested interest in these students’ learning.

There remains little, if any consensus as to what to consistently name what this writer is calling “1:1 implementation models” in this moment. Researchers also struggle to establish workable parameters for generalizable 1:1 research findings. Without a preeminent manner by which the research community quantifies and qualifies the existence of 1:1 models’ total count and nature, there remains a patchwork of disconnected studies. As a result, potential benefits within these studies go unrealized. These effects are felt by the research community and those students and teachers operating in 1:1 programs.

### *Implementation Considerations*

The implementation of a 1:1 model is a complex, multifaceted task no matter the size of its jurisdiction (Zheng et al., 2013, p. 291). Since 1:1 models serve to broaden access to a transformational piece of educational technology, it is helpful to consider how laptops themselves impact the educational process. In this regard, Puentedura’s (2009) Substitution, Augmentation, Modification, and Redefinition (SAMR) model serves as a useful framework for evaluating implemented technologies’ roles in scholastic environments. This model provides a scale for determining the degree to which technology affects the instructional process by distinguishing its role in the context of the canonized mode of teaching and learning that it replaces.

SAMR's usefulness is clear in its contextualization of technology, but it is less so in its use as a guide or suggestion for best practice with regard to implementing 1:1 initiatives. The lowest two levels of the scale (those of substitution and augmentation) are classified as applications of "enhancement" while the remaining, higher levels are those of "transformation" (Puendetura, 2006; 2009). Applying this model as a framework for understanding the implementation of 1:1 programs, in which students' newly ubiquitous laptops are the highlighted technology to evaluate, yields complex understandings of the multifaceted roles that technologies play within schools' ecosystems. While policymakers and teachers may consider SAMR to discuss, or even advocate for, 1:1 laptops' transformational magnitude in the context of teaching and learning, they may also wish to consider whether this carries unintended, undesirable effects that pertain to student focus and distraction (Savignano, 2017, p. 111) or enjoyment (Mouza, 2008, p. 468).

### *Equity and Access*

Given the long-running interests from both the public and private sectors to implement educational technology as a means for achieving equity, access, and student success, the 1:1 model's promise of a device for each student and teacher has proved popular in K-12 schools. The Abell Foundation (2008) notes that 1:1 programs, generally, aim to "increase academic achievement; [...] transform the quality of instruction; [...] increase equity of access and minimize the digital divide; [...] increase the economic competitiveness of students and the region by employing technology to teach twenty-first-century skills" (pp. 1-2). While all four of these goals are laudable in a generalized sense, the extent to which 1:1 programs help to better articulate, effectively pursue, or (ideally) work to achieve these goals varies.

Extrapolating the findings of a 1:1 program is, in itself, a difficult and complex task. Mouza (2008) observed that

research into the educational uses and student outcomes of laptop programs is still in its infancy. In a recent examination of studies analyzing the implementation and effects of laptop initiatives in multiple countries, Penuel (2006) found only 30 studies that used rigorous research procedures, with the majority of those studies focusing on middle/high school students in affluent schools. (p. 448)

Where some existing research focuses on the design, implementation, and outcome(s) of a state, district, or school initiative, other studies deploy an ex post facto analysis model of external or archived criteria (standardized test scores, for example,) in order to identify whether or not a 1:1 program is successful. Further complicating matters is that while most implementation initiatives have common goals, there are often more specific agendas (or benchmarks, or mandates) for each district's choice to adopt a 1:1 model.

### *Scope and Scale*

Penuel (2006) links the “scope and detail of 1:1 initiatives” to their “initiating institutions” (p. 329). In practice, the scope and detail of 1:1 initiatives are largely reflecting on the results of an analysis of technology immersion. Shapley et al. (2010) posit that determining success within 1:1 initiatives “involved much more than just buying laptops for students. Technology immersion requires a comprehensive approach that transforms the school culture, changes the nature of teaching and learning, and expands the educational boundaries of the school and classrooms” (p. 50). With such myriad conclusions for such critical populations, policymakers' decisions to adopt 1:1 frameworks cannot be taken without careful consideration as to who is to gain what from which practices associated with the 1:1 model's implementation. While it is not possible

to guarantee success with such initiatives, and there is not wide agreement as to how, specifically, if one is to best implement a 1:1 laptop model within schools, more research awaits itself as 1:1 structures increasingly proliferate.

One of the distinguishing factors that affect research into 1:1 initiatives is the perennially disparate scope or scale of each jurisdiction's implementation plan. Aside from quantitative considerations like costs, device models, and networking capabilities, how a program is communicated qualitatively to students and teachers may affect successes. Warschauer et al., (2014) noted that

differences in program deployment may have factored into whether obstacles to student access to, and engagement with, technology were overcome. Programs that examined the needs of their student and teacher populations, developed technology infrastructure, and sought support from stakeholders were more successful; the program that relied on technology alone to produce outcomes ultimately failed. (p. 13)

This is problematic when determining the transferability of 1:1 studies' findings, but it is also problematic in that there are often variable interpretations of success within implementations themselves. For example, one stakeholder's goal may be reached while another stakeholder's goal is not. One mixed-methods descriptive and quasi-experimental study investigating the effectiveness of the State of Michigan's Freedom to Learn (FTL) 1:1 initiative, in which over 20,000 laptops were distributed to teachers and students across grade levels to improve students' achievement, develop students' 21<sup>st</sup>-century skills, and improve teachers' pedagogy through professional development (Lowther et al., 2012, p. 2), reached mixed conclusions. Lowther et al. (2012) notes that classrooms within the FTL initiative developed 21<sup>st</sup>-century learning skills, while also noting that "teachers comparably implemented more student-centered strategies such as independent inquiry, project-based learning, and meaningful laptop lessons that directly support

student development of 21<sup>st</sup> century skills (e.g., critical thinking, communication, collaboration, and creativity)” (p. 23). At the same time, the implementation of the 1:1 initiative did not lead to significant advantages in student achievement (p. 27).

### *Standardized Test Scores*

Existing studies do not show consensus in determining the extent to which 1:1 programs affect students’ standardized test scores. Additionally, many studies note the lack of scholarship on these links, both in number and in cohesion (Bebell & Kay, 2010; Bleyer, 2017; Kposowa & Valdez, 2013; Robinson, 2018). Dudley (2018) finds that, in an experimental design study evaluating the extent to which 1:1 programs affect achievement in language arts amongst Mississippi middle school students, “results did not indicate a statistically significant improvement in scores of students issued a laptop nor did they indicate a statistically significant drop in scores for students issued a laptop” (p. 54). While the results of this study indicate that the 1:1 initiative did not serve to disadvantage students, that there is not much observable improvement to attribute to the prevalence of 1:1 programs is also worth noting.

While some studies show that 1:1 initiatives improve some students’ achievement on certain indices (Hull & Duch, 2019, Kposowa & Valdez, 2013, p. 372; Mouza, 2008, p. 468; p. 80), these findings are not consistent (Bebell & O’Dwyer, p. 5; Harper & Milman, 2016, p. 131; Lowther et al., 2012, p. 27; Shapley et al., 2010, p. 49; Weston & Bain, 2010, p. 6; Zheng et al., 2016, p. 1074). When interpreting the results from a quantitative, nonexperimental design study that focused on the scores of Illinois high school students who took the Partnership for the Assessment of Readiness for College and Careers (PARCC) assessment amidst their participation in a 1:1 program, the data

indicated that “except in the case of students attending small high schools, the result demonstrated that high school students not participating in 1:1 laptop programs scored significantly higher than the high school students participating in 1:1 laptop programs” (Bleyer, 2017, p. 63). Ironically, standardized test scores as 1:1 implementation metrics pose the same problem as using handwritten test scores to evaluate students’ ability levels: one measurement encapsulates neither the totality of the student’s nor the initiative’s magnitude.

At the same time, some recent studies suggest that 1:1 initiatives improve students’ achievement levels (Bebell & O’Dwyer, 2010; Shapley et al., 2010). The diversity of findings, with such myriad working criteria, within such a wide range of studies, speaks to the need for more research into the way that 1:1 initiatives affect or improve students’ achievement levels. Kposowa and Valdez (2013) observe that for such a burgeoning area of education, “there is a paucity of research that examines their effectiveness, especially their impact on student academic achievement. Different investigators often working with the same set of variables have produced remarkably different results” (p. 348). Such disparities persist in research studies’ outcomes: these disparities pertaining to students’ achievement make Zucker’s (2004) proposition of a research framework for evaluating the divergent nature of 1:1 studies more prescient. Zucker (2004) suggested that the differing scopes and scales (among other factors) of 1:1 studies and the propensity for some 1:1 studies to rely on “soft” evidence (p. 372) meant that a new framework was in order for evaluating research in this area.

### *Fiscal Considerations*

As prices and sizes of internet-connected laptop computers have waned, the implementation of these devices in educational contexts has waxed accordingly. Still, equipping all students and teachers within a jurisdiction, school district, or school with laptop computers is neither as simple as making a bulk purchase, nor is it the sort of alteration to the educational ecosystem that ought to be taken without careful fiscal consideration. This underscores the troubling notion that—just as in the areas of test scores, scalability, and efficacy—there is little research explicitly linking costs to instructional value (Robinson, 2018, p. 20).

Of interest, too, are the market effects of an industry predicated on regularly outfitting students with the latest technologies as though they are autumn sweaters. To that end, the fact that 1:1 initiatives proliferate while internet-connected laptop computers concurrently emerge as affordable additions to the instructional process may not be entirely coincidental. Valiente (2010) hypothesizes that Maine’s One Laptop per Child Initiative (OLPC) may have catalyzed a new industry class of products entirely, “a new category of low-cost devices, netbooks, which, together, with smartphones, seem to be the technological drivers of contemporary initiatives” (p. 6). Further still, policymakers must also consider and, in some cases, grapple with how their physical and digital infrastructures can cope with wireless technologies (Nair, 2002).

The economic implications of computers wholly or partially developed with scholastic implementations in mind are nearly as daunting as the inherent ethical questions surrounding the explicit marketing to the public education sector at large. Nonetheless, the 1:1 programs’ affordable, durable, quality laptops may be

commensurate with textbooks' replacement costs. An International Data Corporation (IDC) White Paper (2015) focusing on ten school districts who deployed Google Chromebooks to teachers and students in various application capacities found that “on average, these school districts have paid \$310 per Chromebook. In addition, school districts required server resources to support applications running their legacy devices, whereas they do not need servers to support cloud-based Google Apps” (Mainelli & Marden, 2015, p. 8). Since this relative affordability is boldly underscored by its juxtaposition with skyrocketing textbook costs, laptop computers for students and teachers are often pitched to constituents as pragmatic, cost-effective choices that offer the flexibility and upgrade options that traditional textbooks lack. These realities make the inevitably substantial, up-front costs more than worthy of the investment of both time and resources from a fiscal perspective.

#### *The 1:1 Model as Experienced by Administrators, Teachers, and Students*

The following section highlights how 1:1 programs are experienced by administrators, teachers, and students. The functions of each group, and extents to which members of each enjoy agency in 1:1 programs, are examined alongside the extent to which each group's actions are consequential in a 1:1 environment. This section begins with administrators and continues with teachers, the latter of whom are examined through TPACK and CBAM frameworks before focusing on the critical nature of teachers' roles within 1:1 programs. This section finishes with an analysis of students' experiences.

#### *Administrators*

Superintendents, principals, department supervisors, and other administrative personnel found within K–12 schools act as important agents within those districts that

choose to implement the 1:1 model. The importance of these positions in a 1:1 context often surrounds the processes of implementation and management. In their capacities as decisionmakers at the highest level of district-level leadership, superintendents are tasked with helping a change that often includes financial, political, disparate interest, and technology support constraints (Nolin, 2014, p. 169). Accordingly, they (often, with the input of other district leaders) “conduct research, select equipment, identify key players, pilot devices, conduct professional development, and assess the capacity of the technology staff” (p. 169). In addition, superintendents, along with their district and building-level colleagues, are often tasked with garnering and maintaining support from staff and community members en route to a successful implementation. This support-gathering can be conducted through periodic communications with community members, ongoing professional development, and information sessions.

This route to success, though, can be difficult to navigate: existing research suggests that some degree of tension may be inevitable in administrators’ 1:1 program advocacy. One such tension comes from a fundamental issue underpinning schools’ cultures, irrespective of technology altogether: aligning a district’s ambitions (in this case, for deploying educational technology in the instructional process) with the district’s existing educational stylings toward meaningful change. Sauers (2012) highlights the rate of this change as a particular sticking point when a district is moving toward a technologically immersive environment. As perceptions of technology’s myriad promises of efficiency and streamlining do not align with the incremental implementation methods that initiate more substantive change (p. 28), teachers deploying technology within their classrooms can retreat to what is comfortable.

To ameliorate the potential dissent, administrators often seek to change teachers' existing educational attitudes through professional development programs. Still, results are not guaranteed. While Dillon (2017) found that administrators in a high-performing, suburban school district expressed frustration at teachers' proclivity for lecture-based instruction in spite of a district-level commitment to the 1:1 model (p. 116), Detering (2017) noted the importance of high-quality professional development programs in the process to change minds, observing that teachers, once subjected to professional development, either "confirm or challenge" (p. 39) those "new skills or strategies" (p. 39) to which they are exposed in a professional development session. As for how these professional development programs ought to be formulated to implement technology effectively, Sauers (2012), citing Hew and Brush (2006), pointed to three criteria: a "focus on content," professional development sessions that allow for "hands-on work," and an insistence that professional development is "highly consistent with teacher needs" (p. 28). Teachers must see the innate worth of what they are being asked to adopt—here, a 1:1 device model—if they are to part with skepticism and change their perspectives.

Despite the thorough research and planning often conducted by administrators, top-down, 1:1 initiatives may best be served by including multiple stakeholders. A 2016 report to the Minnesota State Legislature that focused on the best practices found within 1:1 programs throughout the state noted that while "approximately 55 percent of Minnesota schools now have some level of a 1:1 program" (Minnesota Department of Education, 2016, p. 6), also taking into account Minnesota's charter schools, "more than 80 percent of those districts have indicated that the school and district leadership are leading the vision for 1:1 initiatives" (p. 6). This report importantly adds that "shared

leadership initiated the largest percentage of programs” (p. 7), defining this “shared” designation as one that is “inclusive of teacher leaders and administrators” (p. 7). The report suggests that collaboration with staff members from the teaching and learning domains is critical to successful implementation. When a 1:1 initiative lacks clear, conscientious links between curriculum, pedagogy, and the deployment of the 1:1 model’s chosen technologies, “programs struggle” (p. 7).

One such struggle facing administrators is an emergent, post-1:1 implementation, technology deployment. When students’ 1:1 education lacks cohesion from class to class, or teacher to teacher, these students’ parents take notice. For those parents earnestly trying to understand how to optimize their students’ experiences in a newly 1:1 educational paradigm, this incoherence is problematic. In a sweeping 2017 survey of 1:1 districts that sought the opinions of thousands of United States’ students, teachers, administrators, parents, and community members across socioeconomic levels, Evans (2018) found that parents’ foremost concern regarding the use of technology in their child’s education “is not student data privacy (24%) or even teachers’ lack of skills using digital tools (18%), but that technology use varies too much from teacher to teacher, class to class, subject to subject (51%)” (p. 2). For educators, it is expected that in any 1:1 program implementation, there will be natural differences in teachers’ pedagogical leanings, that a broad range of subject matter lends itself to different patterns of use, or that teachers’ myriad comfort with digital technologies will lead to variations in the rate of adaptability. At issue for administrators is whether or not these differences are too great or problematic in nature.

## *Teachers*

This section explicates teachers' experiences within a 1:1 model. In this section's first part, the TPACK framework orients 1:1 teachers' experiences with educational technology research. In this section's second part, the CBAM framework considers 1:1 teachers as professionals within an educational institution adopting an innovation. In this section's third and final part, I examine teachers' roles in 1:1 studies.

*TPACK framework.* Most schools experience instructional shifts over time, but the shift to 1:1 education is particularly disruptive for teachers. One-to-one (1:1) programs position teachers in an unfamiliar context: a technological one. This unfamiliarity is evident on several levels. First, teachers' educational technology knowledge is, too often, undeveloped in preservice graduate courses (Niess, 2012, p. 3). Then, when teachers enter the profession unequipped or uncomfortable with educational technology, lacking the knowledge or skills required for optimizing technology's potential, difficulties arise. Mouza (2008) (citing Lowther et al., 2003) observed that "teachers often use technology within their existing practice" (p. 450) when they are compelled to design computer-based lessons. Finally, teachers have individual professional development needs as they adapt to 1:1 initiatives in their workplaces (Donovan et. al., 2007, p. 278; Whicker, 2012, p. 134).

These educational technology needs and concerns are understood as holistic ones in a TPACK conceptual framework. Rather than approach the computers at the center of a 1:1 initiative as isolated skills or domains to be conquered, teachers' needs and concerns are multifaceted and linked. Analyzing teachers' educational technology positionality through the TPACK conceptual framework suggests the need for more than

the device-specific or technology-specific training teachers often receive in schools. Niess (2012) suggested that teachers using educational technologies “need to be engaged in reconsidering content specific concepts and processes along with the impact of the specific technology on the development of those ideas as well as on teaching and learning the content” (p. 5). This process comprises evaluating connections between pedagogical domains, questioning existing beliefs, and revisiting the fundamental assumptions that frame teachers’ vocation. Understanding the depth of these adaptations that teachers make in 1:1 initiatives is critical.

*CBAM framework.* Researchers understand educators’ resistance, adaptation, and adoption of 1:1 initiatives through the CBAM. This framework acknowledges the transformative power of immersive computing by situating the 1:1 student-to-device model as a disruptive, educational innovation. When an educational innovation is introduced to an educational institution’s working context, the CBAM proposes three systems for innovation adoption at work: the resource system and the user system (independently), and a third collaborative adoption system linking the first two (Hall, 1974, p. 9). The resource system is the “agency or institution that can assist the adopters of an innovation” (Hall et al., 1973, p. 7). The user, then, is the one charged with adopting the innovation, while the collaborative system is the temporary mechanism by which innovation knowledge—held by the resource and user—transfers from the former to the latter until it is no longer necessary (pp. 8-9).

This framework helps examine educators’ 1:1 experiences because of its evaluative stages: Stages of Concern (SoC) and Levels of Use (LoU). Applied to 1:1 initiatives, the SoC allow researchers to detail how the laptops, as educational

innovations, change the teachers' feelings (Newhouse, 2001, p. 2). Importantly, by providing space for educators' feelings, the CBAM seriously considers the individual nature of innovation adoption as part of a process. To accompany the SoC, the LoU "identifies what a teacher is doing or not doing relative to the innovation" (p. 3). To consider both of these stages is to understand the relationship between teachers' concerns within a 1:1 program alongside the extent to which the laptops affect their pedagogy.

In both the TPACK and CBAM frameworks, the magnitude of educational change required of teachers in the 1:1 model is substantial. For some instructors, there is not only a technological gap, but there is also an instructional one. Donovan et al. (2007) observed there is a "critical connection between technology integration and teacher practice. In essence, teachers whose classrooms are more traditional are being asked to adopt two innovations—the one-to-one computing environment and a more student-centered classroom" (p. 18). In this way, the *de facto* standardization of a technology-infused environment can innately privilege those who bear existing technological competencies. This cognitive dissonance in itself makes for an (at best) uneven or (at worst) inequitable educational experience.

*Teachers' roles.* The teacher plays a critical role within the 1:1 model. The introduction of new educational technologies to the K–12 instructional process presents multifaceted, complex challenges. Teachers help their schools by capitalizing on new educational technologies. Boling and Beatty (2012) acknowledge the teacher's capacity for deploying educational technology by referring to the teacher, within the TPACK framework, as the "innovator" (p. 140). Citing Hennessy, Deane, and Ruthven (2003), Niess (2005), and Ropp (2009), Boling and Beatty (2012) note that educational

technologies' deployment can present challenges related to "educators' dispositions toward themselves, the technology that they are using, and the subject matter that they are teaching" (p. 141).

Teachers are pivotal determinants in the success of a 1:1 initiative. Bebell and Kay (2010) suggested that "it is impossible to overstate the power of individual teachers in the success or failure of 1:1 computing" (p. 48). Even if a given program is well-intentioned and well-designed, teachers are the practitioners who model and instruct within the new learning paradigm these computers represent within the instructional process. With this in mind, it is important to understand just how significant a change the 1:1 model represents to teachers who are unaccustomed to it. In addition to changing the very nature of the teaching profession, teachers' dispositions have to be taken into consideration when initiatives such as these are to be implemented.

The 1:1 program was largely seen as a challenge or disruptive event, although teachers' responses to this disruption varied. Those with a fixed mindset struggled to see changes to established norms as positive, whereas those with more flexible mindsets tended to interpret new practices not only as interesting, but as improvements. In this way, the more established a teacher's notion of what and how students should learn (and what/how teachers should teach), the more likely they were to demonstrate decoupling via a skeptical implementation of the program. Decoupling of practice and paradigm was not reported by teachers who demonstrated a more flexible mindset. (Gherardi, 2017, p. 183)

It is essential to understand teachers' experiences in 1:1 contexts, as this can help to drive both instruction and further research. Strother (2013) observed that understanding the teacher's environment in a 1:1 classroom is "essential" (p. 84) because of the implications for students' outcomes. Detering (2017) contextualized the difficulties that 1:1 programs present to teachers by reminding readers that 1:1 programs have already shifted education, noting that "school districts that implement 1:1 computing programs

produce challenges for high school teachers and administrators. The traditional curriculum, and corresponding teaching methodologies, are changing to embrace 1:1 computing programs” (p. 104). In this way, when teachers are experimenting, tinkering, and ultimately mastering an aspect of the 1:1 model, they are less participants and more change agents within education as a whole.

Research suggests that, in order to progress toward the most optimal outcome for a given 1:1 initiative, teachers who work in such districts need quality professional development (Savignano, 2018; Strother, 2013; Valiente, 2010) and consistent messaging regarding the 1:1 program’s goals (Gherardi, 2017; Valiente, 2010). An employer’s decision to alter a core component of an employee’s chosen vocation merits a significant degree of ongoing support for such a change (especially in those cases in which this decision is made without the employee’s input). Still, the marginalization of teachers’ opinions can be a mitigating factor in 1:1 programs’ success (Donovan et al., 2007, p. 265). Sauers (2012) commented on the disconnect that some teachers feel when they have been excluded from discussions surrounding technology integration, writing,

teachers have routinely been given technology with minimal training. True change has also been slowed because many of the technology initiatives have been top down policy initiatives. Teachers have not had input in the decision-making, and haven’t fully understood or supported the change. (pp. 22-23)

Also critical to notions of successful implementation are teachers’ open-mindedness with regard to technology, pedagogy, and quality instruction. In addition to—and perhaps related to—the marginalization that teachers have experienced, is what Gherardi (2017) terms “the adoption of flexible notions of what and how students should learn” (p. 19). This researcher suggests this practice “mediates a positive response to a technology-

informed paradigm” (p. 19). Importantly, if teachers lack a willingness to embrace the 1:1 program, the consequences permeate the instructional process in subtler ways.

What remedies such disconnects is unclear, but some existing research highlights issues within universities’ technology-driven teacher training programs (Detering, 2017, p. 106; Reyes et al., 2017), shedding light on the disparate levels of educators’ engagement within 1:1 initiatives. This phenomenon suggests that merging technological understanding with pedagogical expertise is perhaps less of a modernist luxury and more of a fundamental component of a teacher’s training.

The educational possibilities for 1:1 programs are well-publicized, intriguing, and suggestive of both innovative and, in some cases, transformational outcomes. These programs’ popularity already indicates some practical application within the instructional process, but these outcomes cannot be trusted uncritically. Evans (2018) notes that “53% of principals with a 1:1 program report that technology is used effectively in math classes at their school with resulting academic benefits. Only 43% of all principals say the same about technology usage in their math classrooms” (p. 2). The context of these findings should not be separated from the results: many of these principals have some stake—perhaps tangibly, perhaps not—to declare that digital investments in technology and infrastructure are beneficial. While the existing body of research suggests that despite the massive push to technofix the modern American classroom, serious questions remain as to the efficacy, clarity, financial costs, and pedagogical transformations within 1:1 districts; the often conflicting pieces of transferable knowledge that come from scholarly research in this regard make for an impoverished discourse.

Current research gaps, inconsistencies, and contradictory results suggest a need for best practices in order to help schools' stakeholders make the best decisions on a number of fronts. By this point, there are more than enough 1:1 districts with more than enough experiences to reasonably move large-scale laptop distribution debates into a new phase. Without robust, clear, and transferable understandings that result in best practices, school districts rely on the aggregate opinions that reflect general understandings or localized dynamics outside of the initiatives themselves. This is not to suggest that as many opinions ought to be sought as possible. Certainly, the opinions of all stakeholders within surveys are essential to a complete understanding of 1:1 initiatives, but it must also be acknowledged that conflicting interests reflect a spectrum of interests.

### *Students*

One of these subtleties manifests, of course, in students' varying experiences within 1:1 programs. While teachers' importance is perhaps difficult to overestimate, the students themselves are the reason for the teachers' (and, thus, the laptops') presence in the classroom in the first place. How students' education is impacted by the implementation of a 1:1 program can be measured in any number of ways, but it is important to note that there is limited understanding or consensus on the transferability of findings when one accounts for demography. For students of different ages, ability levels, demographics, locations, and for students spanning daunting lists of socioeconomic factors, it is hard to unilaterally apply findings from one study to another as best practices or cautionary narratives. With regard to students, specifically, this literature review focuses, then, on that research that sought either explicitly or implicitly to comment on transferable understandings.

As the previous section dealt with teachers' vital roles within 1:1 programs, it is helpful to understand students' unique lived experiences within these programs whose actions or inactions carry enormous influence on their students' lives. By virtue of teachers' important positions as both practitioners and authority figures, when a school or district bears an inherent issue of teacher turnover, for example, those who are supposed to be learning from technology are the ones tasked with teaching the technology.

Transience of teachers and administration also means that some of the most consistent players within the one to one programs might very well be the students and classified staff. Their involvement in developing, implementing, and sustaining the one to one program should be enlisted, as their experience is one that brings a unique stabilizing perspective with it. (Whicker, 2012, p. 141)

On one hand, this speaks to students' incredible resilience in the face of relative instability. Taken another way, this can be interpreted as a testament to teachers' influence: just as with their actions or inactions, their presence or lack of presence in itself makes for a critical difference in the success of a given program. Through a third interpretive lens, the sophistication of laptop computers is not to be outdone by the impressionability of children and teenagers.

The notion that students are innately impressionable could speak to the relative inconsistency of existent 1:1 studies' findings with regard to students' perceptions of their use of the devices. In a longitudinal study conducted over five years that focused on a district in its third year, Berger-Tikochinski et al. (2016) found that on the whole, while students enrolled in 1:1 classes "report a better learning experience" (p. 170), there remained situational differences in students' perceptions of their own experiences. Berger-Tikochinski et al. (2016) reported that:

The findings indicate an ‘up & down’ effect, where the attitudes and motivation of students towards learning with a 1:1 laptop change over the years, but this change is not the same when viewed in terms of ‘duration of learning’ – the effect of learning in the program on the same students; and ‘duration of program in school’ – the effect of the program on different students in different school years. (p. 185)

While within these contrasts is the acknowledgment that there are complex factors affecting students’ perceptions of 1:1 initiatives, this is not to suggest that developing best practices—in discerning how to garner the most meaning from students’ experiences—is not important. There, too, must be an acknowledgment as to the pivotal role that technology plays, not only in the lives of contemporary students, but also most people in general. Detering (2017) summarized this duality, noting that “it is difficult to predict the impact of technology and 1:1 computing programs on the future of education, but it would be difficult to deny that technology will continue to shape the world that students live, as well as the face of education” (p. 112). That technology is to play a role in the future of education is nearly undisputed; determining the contexts or the intentionality of these deployments is to address only two of the many fundamental questions that surround a technology-laden instructional process and, by consequence, the 1:1 model.

### *Conclusion*

Penuel’s (2006) characterization of 1:1 initiatives—also used within a 2008 Abell Foundation report on the topic (p. 1)—serves as an operative definition here within this literature review. Penuel (2006) distinguished the proliferating, if still nascent, presence of emergent 1:1 studies covered in his research synthesis by way of three criteria:

[initiatives] (1) providing students with use of portable laptop computers loaded with contemporary productivity software (e.g., word processing tools, spreadsheet tools, etc.), (2) enabling students to access the Internet

through schools' wireless networks, and (3) a focus on using laptops to help complete academic tasks such as homework assignments, tests, and presentations. (p. 331)

While this literature review also uses these criteria as constraints for analyzing 1:1 studies, this is not to suggest that available research studies that, for example, focus on internet-connected tablet computers (e.g., iPads) or smartphones lack relevance or bearing on 1:1 considerations. The laptop computer distinction is rooted in the laptop's longer history of use and its ongoing proliferation.

By standardizing or institutionalizing an environment in which ubiquitous laptop computers become synonymous with learning contexts, it is worth exploring the ethical implications for crafting and subsequently enabling a world in which digital inundation is the norm. As an example of the power that digital ecosystems command in terms of their profound influence on the macroculture, Spangler (2015) observed (citing Bellamkonda, 2011) that since digital natives have invested so heavily in digital spaces such as social media, other demographics outside of their age group have had to, in turn, heavily invest themselves if they would like to access the market power that digital natives possess (p. 38). In this way, the norms developed by these digital natives are those that others must—if not adopt outright—confront.

Whether it is worth emulating (or arguably, retrofitting) a complex, ever-turbulent and digital world to the classroom with digital technologies in constant need of updating, is also worth considering in the context of what knowledge is transferred innately within digital domains in the first place. A symbolic embrace such as this—one toward ubiquitous technology in the classroom, empowered by the 1:1 model's

implementation—suggests a new prioritization of new understandings as well. Sweeny (2010) observed,

historical definitions of semiotics—the study of communications signs and symbols—viewed language and communication as a stable system with defined rules, but that theoretical base is changing in response to the evolving nature of language and communication now possible with digital technologies (Kress, 2000). Rather than merely being consumers of information, the broader public can now be producers and collaborators as well. (p. 122)

That this analysis echoes Bloom's (1956/2001) revised notions of synthesis or creation as the highest level of understanding is not likely the result of a fortunate accident. As the gatekeepers of content dissemination, who have blocked access to the highest echelons of publishing across as many mediums as generations, continue to be marginalized by the information pipeline that is the internet, so too does this world of opportunity present itself to those students in 1:1 classrooms. In many ways, this straighter (or, at least, more expedient) line from obscurity to success may improve issues of equity or access, but there must also be serious consideration for the nature of the success that is enabled by the internet-connected laptops within classrooms.

To that end, there are two concurrent gaps in the literature. The foremost runs from quantitative studies, to qualitative studies, and on through mixed-methods approaches. There are not enough research studies focused on social experiences. This is disconcerting in the midst of such a pervasive, uncritical push to not simply integrate technology into the classroom, but truly immerse school populations.

The second gap in the literature on 1:1 initiatives is the one that positions on one side those studies that determine success as the attainment or alignment of a 1:1 implementation with its stated aims across from those studies that determine success by a

series of more holistic factors. Collectively constructing norms, formulating more empirical definitions of success, or more comprehensively and consistently aligning that existent research data in more meaningful ways could lead researchers to more accurately project the successes of 1:1 implementations. Also, longitudinal studies that follow 1:1 students who have gone on to college, the workforce, and beyond may yield greater understandings of the social and emotional impacts that these students have carried onward into their adult lives. Certainly, as understandings move from static commands of canonized knowledge bases into a more agile, more comprehensive grasp of dynamic knowledge avenues, researchers will be able to understand how these students' prospective performances are affected by a version of education that is, in every way spare the very recent past, unprecedented.

As a final point worth considering, an increasingly grim and equally pervasive reality is the diminishing sliver of privacy that anyone who utilizes digital mediums is sure to suffer. Administrators' role in perpetuating this reality by asking students to conduct themselves in these spaces is worth serious consideration. Stakeholders may not be aware of the implications of students' lack of privacy. There also may not be best practices developed by a given jurisdiction for what is and what is not tracked, logged, or monitored in terms of stakeholders' use of devices within the 1:1 program.

How students cope with the understanding (or lack of understanding) of how their data are used may serve as a model for how the next generation values such an issue as basic as privacy. In this way, a digitally-connected generation may serve to do what those first digital natives did to ideas of intimacy, connectivity, and of course, social interaction: upend them. They may serve to take such a static, entrenched, obvious notion

as privacy and make it obsolete. Before the 1:1 initiative becomes as unquestionably appropriate for a productive life as a young student in public schools, the implementation of these programs must be studied to the extent that there is a more definitive sense of intentionality in these programs' deployment.

After all, educators who teach in districts that have adopted a 1:1 model have expressed their concerns (Berger-Tikochinski, Zion, & Spektor-Levy, 2016; Savignano, 2017; Whicker, 2012; Warschauer et al., 2014). From a sociological standpoint, as 1:1 programs permeate the K–12 educational sphere, the extent to which teacher practitioners ought to model the adult, professional, computer-saturated working world is an open, unanswered question. From an educational standpoint, even if computers are helpful to students and teachers, the extent to which students' computer use improves educational outcomes is not well known, and existing studies show conflicting degrees of evidence to this dilemma (Bebell & Kay, 2010; Bleyer, 2017; Kposowa & Valdez, 2013; Robinson, 2018; Sauers & McLeod, 2018; Tamim et al., 2011).

Evidence that points to the positive effects of technological implementation must be taken amidst a wider debate as to how school districts and policymakers are to optimize their resources. A 2011, second-order meta-analysis of 40 years' worth of research into the extent to which technology changes education for the better (when compared to no technology at all) found that “aspects of the goals of instruction, pedagogy, teacher effectiveness, subject matter, age level, fidelity of technology implementation, and possibly other factors that may represent more powerful influences on effect sizes than the nature of the technology intervention” (Tamim et al., 2011, p. 17). When one implements personal computers as educational resources allocated to schools'

stakeholders at the expense of another educational resource (from a limited pool of funding), this decision raises several issues. Personal computers (like many textbooks, anthologies, and other classroom supplies) need to be updated regularly. Vendor contracts—for software systems, programs, and platforms—expire. These issues are weighted along with the technical infrastructure and, in some cases, support staff necessary to maintain these devices.

While all scholastic disciplines are affected when personal computers are a central component of the instructional process, there are specific effects for teachers and students engaged in specific courses, such as English language arts. When students are engaged with compositional tasks (essay writing, editing, revising, etc.), academic integrity can be difficult to maintain in a digital, internet-connected learning environment. There is also debate as to whether (or which kinds of) computers offer a superior medium when comparing students' digital writing tasks to handwritten ones (Ling & Bridgeman, 2013; Lisy, 2015; Wollscheid et al., 2016). Despite 1:1 initiatives' popularity, there must be a more thorough examination of whether it is a best practice for students to engage with the nearly limitless accessibility to online resources that laptop computers provide.

There are also multifaceted repercussions for those teachers who reject the technological implementation programs that districts adopt (Detering, 2017; Donovan et al., 2007; Gherardi, 2017; Strother, 2013; Valiente, 2010). These teachers risk being left behind by an instructional model from which they are excluded, voluntarily or not. It is also unclear if, on a wide scale, teachers receive training (through tutorials, ongoing professional development, or through other support initiatives) commensurate with the mastery required to best develop their students. Some research indicates a varying degree

to which educators are familiar enough with these devices to use them in their most effective manner (Gherardi, 2017; Savignano, 2017).

For students, the stated educational benefits of 1:1 initiatives are diverse and, oftentimes, dependent upon the local aims of the jurisdiction implementing this model. These come alongside the broader ambitions of improved equity and access: when all students can readily access personal computers, there is a more equal socioeconomic plane from which students may elevate their education. Some studies support this assertion. Shapley et al. (2010) found that ubiquitous access to laptops incentivized “Home Learning” (pp. 48-49): situations in which students could access educational resources from home to continue their learning outside of the classroom. In the classroom, some studies have shown that students who utilize computers within the instructional process have shown growth on given tasks (Bebell & Kay, 2010; Lowther et al., 2012), but it is unclear whether or not one-to-one computer initiatives, distinctly, have a significant impact on standardized test scores (Bebell & Kay, 2010; Bleyer, 2017; Kposowa & Valdez, 2013; Robinson, 2018).

More research is needed to provide focused guidance. It is worth considering which specific tasks, environments, ages, ability levels, and disciplines are enhanced by the more sophisticated digital ecosystem inherent in the 1:1 model. Stakeholders need to understand the effects of the changes they are making to the educational process. While the effects of replacing one piece of technology for another (i.e., word processors replace penmanship) is somewhat understood (Puentedura, 2006; 2009), how complex, digital ecosystems affect nuanced understandings is not.

## CHAPTER THREE

### Methodology

#### *Introduction*

The last chapter's conclusions suggested that 1:1 programs' proliferation outpaced research consensus, that general research on 1:1 programs remains necessary, and that research examining these programs' impacts on students' communication and social skills is sparse. In light of these conclusions, this study addressed a 1:1 program during the fourth and final year of its implementation. This study focused on links between the program's implementation and impacts to high school students' communication and social skills. This study examined these relationships by eliciting the opinions of those best positioned to understand such relationships' intricacies and manifestations: their teachers.

This qualitative case study answered the following research question: what impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? This question's answer yielded a more thorough understanding of social changes taking place after 1:1 programs' implementation. A more comprehensive understanding of these changes allows school leaders to strategically account for them in advance, increasing the chances of future implementations' success in all regards.

### *Researcher Perspective*

I have a tangential relationship to the research site, Suburban Community Regional High School (SCRHS; pseudonym), and the study's participants (teachers employed at SCRHS). SCRHS is, along with Suburban Regional High School (SRHS; pseudonym), one of two high schools comprising the Suburban Community Regional School District (SCRSD; pseudonym). I have been employed as an English teacher at SRHS for seven years; I started teaching at SRHS in September of 2013.

As a result of this relationship, I am arguably an organizational insider. While I conducted research within my employer's overarching jurisdiction, I neither did so at my place of employment nor with any colleagues or supervisors. Though a handful of SCRHS administrators are district-level employees who split their time between both schools, each school has entirely separate, building-level, administrative staff (e.g., principals, assistant principals, athletic departments), teaching faculty, and student populations. As a result of this separation, I am only casually familiar with a few teachers at SCRHS.

A pragmatist's worldview guided this study. My ten years of teaching experience in two New Jersey public schools informed this worldview. Throughout these ten years, I noticed how technological advancements adopted (formally and informally) by teachers and students yielded social consequences. I also noticed how differently teachers regarded these changes. Though I believe educational technology can help teaching and learning in many ways, I also believe studying educational technology adoption's social consequences aids prospective improvements. As a result, I am a hopeful—if critical—educational technology adopter.

This study's pragmatism adhered to the understanding of this term Dewey (1923) distinguished by "its essential feature [...] to maintain the continuity of knowing with an activity which purposely modifies the environment" (p. 400). Dewey conceived of knowledge as ongoing and coupled to action, critically separating knowledge's constitution from knowledge's practice to emphasize the utility of the latter:

While the content of knowledge is what *has* happened, what is taken as finished and hence settled and sure, the *reference* of knowledge is future or prospective. For knowledge furnishes the means of understanding or giving meaning to what is still going on and what is to be done (p. 397).

In Dewey's pragmatism, he implicitly relegates theory to an antecedent role that is less useful because theorizing conjures representations of reality rather than participatory reality. Nearly sixty years onward, Rorty (1980)—referencing Dewey and his pragmatist contemporaries—validated Dewey's conceptualizations of knowledge and truth when he suggested that "the pragmatists tell us, it is the vocabulary of practise rather than of theory, of action rather than contemplation, in which one case something useful about truth" (p. 722). Accordingly, this study aligned with Rorty's (1980) characterization of pragmatism as a philosophy that acknowledges "there is no epistemological difference between truth about what ought to be and truth about what is, nor any metaphysical difference between facts and values, nor any methodological difference between morality and science" (p. 723).

Both Dewey's and Rorty's pragmatism were philosophically well-suited for this study because I was less concerned with dissecting factors catalyzing 1:1 programs' proliferation than I was concerned with understanding how these programs affected their most immediate constituents' social realities. Therefore, I valued Dewey's and Rorty's

utilitarian conception of knowledge: theory without practice is significantly less useful than the inverse.

### *Theoretical Frameworks*

Dewey's and Rorty's pragmatism informed this study via two conceptual frameworks: Technological Pedagogical Content Knowledge (TPCK or TPACK) and the Concerns Based Adoption Model (CBAM). A pragmatist's worldview guided each of these frameworks' applications. TPACK's pragmatism was evident in that this conceptual framework "highlights the interactions that occur between these various types of knowledge (including knowledge of technology and technological pedagogical content knowledge) as teachers acquire the knowledge and skills that are needed to successfully integrate technology into their classrooms" (Boling & Beatty, 2012, p. 141). TPACK recognizes a pragmatic reality in legitimizing teachers' funds of knowledge as complex, varied, and not archived in distinct domains, but instead interactive and dynamic in their actionability. When teachers work with technology, their new knowledge is evident when it is put into practice. Thus, this study's research design regarded its participants' observations within a TPACK framework when it valued their educational technology observations as equally valid, multifaceted, and divergent, irrespective of their academic disciplines.

Where TPACK aptly emphasized this study's regard for teachers' complex relationships with educational innovations, the CBAM provided a pragmatic framework for understanding how educational institutions like SCRHS adopt innovations like the district-issued laptops. This framework's pragmatism is evident in the CBAM's concession that each institution, each institution's constituent members, and each

innovation are distinct. To analyze an educational innovation, according to the CBAM, is to “begin with viewing the adopting institution as a User System composed of individuals, each of whom has his own sets of concerns, problems, skills, agendas and needs. In combination these individuals represent the institution and its functioning” (Hall, 1974, p. 8). This study used the CBAM to rationalize participants’ divergent observations and perspectives following the 1:1 implementation.

Both the CBAM and the TPACK frameworks shaped this study’s research question. TPACK is predicated on the idea that teachers’ knowledge is multifaceted, and not limited to subject matter within their chosen content area. TPACK “describes a dynamic framework for describing teachers’ knowledge for designing, implementing, and evaluating curriculum with technology” (Niess, 2012, p. 9), and this study’s research question highlighted teachers’ agency in the aforementioned definition by analyzing teachers’ observations of impacts to students’ communication and social skills following a 1:1 program’s implementation. This study situated this process as a necessary development of TPACK by examining teachers’ educational technology perspectives.

Similarly, the CBAM informed this study’s research question when it treated teachers’ sensemaking—in this latter case, regarding the framework’s educational innovation adoption—as normal and necessary. Rather than evaluating processes by which the 1:1 initiative’s computers were adopted, this study asked teachers their perceptions of students’ social and communicative experiences so that subsequent educational innovation adoptions may be better analyzed with these perceptions in mind. Any ensuing, improved analysis that takes students’ social experiences into consideration may come via TPACK evaluation instruments.

The TPACK and CBAM frameworks also informed this study's data collection protocols. The CBAM allowed for a data collection protocol that did not focus on empirical classroom technology use as a metric for an innovation's adoption; it instead allowed for participants' (i.e., educational organizations' stakeholders') views to evolve over time, according to both personal and environmental factors. The questionnaire, semi-structured participant interviews, and open-ended participant responses used in this study centralized teachers' personal considerations. At the same time, these data streams included environmental factors. The CBAM treats organizations as distinct entities and teachers as individual change agents bearing both personal and institutional motives for educational technology adoption (Hall, 1974). Thus, this framework guided this study's data collection.

The TPACK framework informed this study's data collection protocols. Collecting data focused on teachers' perceptions of educational technologies' impacts on students—via questionnaire, via interview, and via open-ended responses—fulfilled the need for TPACK research that can “assess teachers' beliefs and experiences that direct how they think about their content and how that content is learned in connection with using appropriate technologies for engaging students in learning the content” (Niess, 2012, p. 11). While TPACK generally prioritizes educational indices (e.g., students' performances on assessments, classroom observations of teachers' pedagogy, level of educational technology adoption in lesson plans) for assessment, Niess (2012) noted that, first, “the clarification of what is meant by TPACK is critical to the identification of assessments to measure the construct” (pp. 10–11). By collecting data comprised of teachers' sensemaking—especially data focused on their regard for changes wrought by

educational technologies' adoption over time—future researchers are more informed as to how teachers process educational technologies' effects on their students.

Both frameworks also guided my approach to data assessment. Broadly, the CBAM served as an interpersonal analytical lens, and TPACK provided a lens for individual analysis. The CBAM's individual user adoption system (Hall, 1974, pp. 10–14) provided a framework for rationalizing the disparate extents to which this study's participants experienced educational technology adoption. These differences were better understood when assessed within the CBAM's systems and interactions between these systems. For TPACK, since the “assessment of TPACK is in its infancy” (Niess, 2012, p. 10), this study eschewed the use of an instrument; no such instrument seemed apt for analyzing this study's collected data. Also, this study diverged from TPACK's focus on the extent to which teachers' knowledge affects educational technology adoption; this study did not seek to measure, for example, the extent to which the 1:1 initiative's computers were used. As a result, this study's data analysis was guided by the needs for more comprehensive understandings of teachers' observations of students' interactions with one another, their observations of behaviors not easily categorized as desirable or undesirable, educational or noneducational. In qualitatively coding and analyzing questionnaire responses, semi-structured participant interviews, and open-ended participant responses for emergent themes, this study uncovered an aspect of TPACK not often considered: social and communicative impacts of educational technology adoption.

### *Research Design*

This qualitative case study was bounded by location (Suburban Community Regional High School) and place in time (July of 2020–February of 2021). Despite the

unique timing of the 2020–2021 academic year in the context of SCRSD’s 1:1 initiative, this uniqueness was limited to the district in scope. Accordingly, this study was an instrumental (as opposed to an intrinsic) case study, as this study “focuses on an issue or concern and then selects one bounded case to illustrate this issue” (Creswell & Poth, 2018, p. 98). This research design was most appropriate for answering this study’s research question because, most importantly, its application acknowledged and tolerated an epistemological view in which emergent contrasts are not treated as problems to be reconciled. Secondly, the case study research design requires the researcher to “try hard to understand how the actors, the people being studied, see things [...] the qualitative case researcher tries to preserve the *multiple realities*, the different and even contradictory views of what is happening” (Stake, 1995, p. 12). Just as participants in Strother’s (2013) study, along with a litany of other 1:1 study participants, expressed contradictory or conditional opinions on similar subject matter without undermining that study’s findings, I neither expected nor found that this study’s participants’ perspectives coalesced at a singular point.

This study’s research design pragmatically considered the environment (the school), the participants (teachers), and the phenomenon (students’ communication and social skills since the 1:1 program’s implementation). Yin (1994) explained how the case study research design allows for the aforementioned factors to synergize toward the goal, that of developing a comprehensive understanding of the phenomenon in question:

Because phenomenon and context are not always distinguishable in real-life situations, a whole set of other technical characteristics, including data collection and data analysis strategies become the second part of our technical definition: The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence,

with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis. (p. 13)

In this study, Yin's "triangulation" occurred when themes emerged from data culled from multiple sources. Each of this study's stages was designed to "work inductively, building patterns, categories, and themes from the bottom up by organizing the data into increasingly more abstract units of information" (Creswell & Creswell, 2018, p. 181) so that emic issues developed via triangulation amongst the sources, as analyzing a single source forces the researcher to interpret beyond reasonable bounds.

The case study research design was chosen after considering the merits and weaknesses of several qualitative (and mixed methods) research designs. Ultimately, the case study was chosen after strongly considering both the ethnography and the phenomenology. While both the ethnography's culture-sharing and the phenomenology's emphasis on multiple participants' perspectives (Creswell & Poth, 2018, p. 104) were likely to manifest to an extent, this study intentionally prioritized the 1:1 implementation program's impacts on students' communication and social skills. Since these impacts were observational, bounded by their immediacy, thus tied to the localized and contemporaneous circumstances of SCRHS, these qualities signified a case study's research design.

Some researchers regarded this study's research design attributes as weaknesses in educational technology research contexts. Ronau and Rakes (2012) listed "qualitative studies (including case studies, ethnographies, interviews, focus groups, observations, and action research)" in educational technology research as those lacking "rigorous evidence" (p. 325). In spite of this indictment, there remains a need for case studies

exploring seemingly inscrutable subject matter. To conduct prospective analyses and meta-analyses on relationships between educational technology implementation and social impacts, researchers must first understand how these relationships affect their stakeholders. Case studies like this one seek to understand such changes. Ronau and Rakes (2012) also noted that “much of the work, therefore, in educational technology and teacher knowledge has remained largely at the exploratory, descriptive phases, and has not even progressed to the exploration of malleable factors” (p. 326). These researchers’ diction—in particular, their use of “not even”—suggested they believed the research literature inadequate. Though such inadequacy may be undesirable, it is nevertheless the reality that must be pragmatically wrangled and understood, even in early stages.

### *Data Collection*

I collected this study’s data in three stages, over the course of four months: from November of 2020 through February of 2021. Due to the COVID-19 Pandemic, this study’s data were collected remotely. Since I was not able to collect data on-site at Suburban Community Regional High School (SCRHS), I used software to remotely elicit questionnaire responses, to conduct participant interviews, and to collect open-ended participant responses. This section explains this study’s collection circumstances and procedures. First, this section explains this study’s data collection site. Second, this section explains this study’s sampling protocol and participant selection process. Finally, this section explains this study’s data collection protocol.

### *Site of Data Collection*

I remotely collected all of this study’s data using cloud-based software programs. To collect questionnaire responses and open-ended responses, I used Microsoft Forms.

To remotely conduct interviews, I used Zoom. Though I collected this study's data remotely, all data came from teachers currently employed at SCRHS in New Jersey. SCRHS is located in Morris County, between 30 and 40 miles from New York City, New York. SCRHS is—in addition to Suburban Regional High School (SRHS)—one of two public, regional high schools within the Suburban Community Regional School District (SCRSD). I collected this study's data in three stages: via questionnaire, via semi-structured interviews with selected questionnaire participants, and via open-ended responses completed by these same, selected participants. This data was not collected on-site due to the access restrictions and changes to the district's school calendar wrought by the onset of the COVID-19 Pandemic in March of 2020.

Unique, localized circumstances bounded this case study. The 2020–2021 academic year was the first in which all SCRSD students, in grades 9–12, were issued laptops by the district as part of its ongoing 1:1 initiative. The first phase of SCRSD's 1:1 implementation took place during the 2017–2018 academic year, during which that year's incoming ninth grade students received their district-issued laptops at the start of the academic year. Since then, successive ninth grade classes were issued laptops. Since the 12th grade students who graduated in June of 2020 were the last to do so without a district-issued device, the 2020–2021 academic year marked a pivotal time to study the district's 1:1 initiative.

To acknowledge the dynamic intersectionality of race, gender, ethnicity, location, and socioeconomic status in public schools, this section lists demographic information pertaining to SCRHS students and teaching faculty as of the 2018–2019 academic year, the latest academic year for which this data was available. During the 2018–2019

academic year, the student body of SCRHS consisted of 1271 pupils. 256 (20.14 percent of total student body) of these students qualified for free lunch and 89.5 (7.04 percent) students qualified for reduced lunch. 53 (4.17 percent) students were English language learners. With regard to race, there were 16 (1.26 percent) students belonging to two or more races, 134 (10.54 percent) Asian students, 52 (4.1 percent) Black students, 477.5 (37.57 percent) Hispanic students, one (0.08 percent) Native Hawaiian/Pacific Islander, and 590.5 (46.46 percent) White students enrolled at SCRHS (New Jersey Department of Education, 2019a). The certificated teaching faculty at SCRHS during the 2018–2019 academic year consisted of 120.2 teachers, of which 76 were female and 44.2 were male. Of these teachers, six (5 percent of total certificated, teaching faculty) were Hispanic and 114.2 (95 percent) were White (New Jersey Department of Education, 2019b). These SCRHS students were primarily (with the exception of students enrolled in the SCRSD school choice program in which a fixed number of out-of-district students enter a lottery for the opportunity to attend either SCRHS or SRHS while paying tuition,) culled from three sending municipalities. Since each of these sending municipalities also comprises its own respective school district, SCRHS is considered a regional high school.

### *Participants and Sampling*

Since 1:1 programs' impacts on students' communication and social skills are neither widely understood nor widely studied, I sampled participants according to maximal variation sampling methods. This sampling procedure suited this study because it was—perhaps more so than typical or extreme sampling—helpful for developing a topic's understanding. Maximal variation sampling “requires that [the researcher] identify the characteristic and then find sites or individuals that display different dimensions of

that characteristic” (Creswell, 2005, p. 204). The “characteristic” in this study was its central phenomenon: the 1:1 program’s impacts on students’ communication and social skills, as detailed by their teachers. This decision—to collect data according to a maximal variation sampling methodology—preceded this study’s data collection; I designed this study to incorporate multiple, diverse perspectives (p. 205).

I used this study’s sampling methodology to elicit emic issues. Stake (1995) described emic issues as “the issues of the actors, the people who belong to the case. These are the issues from the inside” (p. 20). Since the case study research design asks researchers to discover these issues in the interest of “particularization, not generalization” (p. 8), study participants fulfilled three criteria to arrive at such particularization required for participation. First, all participants were full-time teachers currently employed at SCRHS. Second, these participants were employed as teachers within SCRSD since the beginning of the district’s 1:1 initiative. Third, participants answered this study’s questionnaire.

Five teachers participated in this study’s three-stage data collection process. After 24 teachers responded to this study’s questionnaire, I used a maximal variation sampling methodology to identify six study participants whose diverse questionnaire responses represented a spectrum of variable perspectives. When one of these six participants could not complete the second and third stages of this study’s data collection process, five participants remained. These five participants completed semi-structured interviews and open-ended responses (in addition to this study’s initial questionnaire).

### *Data Collection Procedures*

This study collected and utilized three forms of data, in three stages, to understand how teachers perceived the impacts of a 1:1 program on students' communication and social skills. Generally, qualitative researchers collect multiple forms of data unburdened by the instruments more typical of quantitative research (Creswell & Creswell, 2018, p. 181). With regard to case studies in particular, Creswell and Poth (2018) detailed the data collection activities according to research designs, distinguishing "forms, such as documents and records, interviews, observation, and physical artifacts for 1 to 4 cases" (p. 150) as those typifying the case study design. To align with this rendering of case study data collection, this study's data were collected from three sources: questionnaire responses, semi-structured interviews, and open-ended responses.

These data were collected in three stages. The first stage used a questionnaire to elicit data. This questionnaire was digitally created and administered using Microsoft Forms. In this stage, SCRHS faculty members received an email on November 23, 2020, including this study's questionnaire, its consent form, and an explanation of this study's scope, nature, and participation criteria. Since it was logistically unfeasible to send this email to SCRHS faculty members from my SCRSD email account, this email and its contents were forwarded to SCRHS faculty members by the SCRHS principal. After this initial email, SCRHS faculty members received several more to encourage further participation in this study. At the first data stage's conclusion on January 18, 2021, a total of 24 teachers responded to the questionnaire.

The second data collection stage used semi-structured participant interviews to elicit data. I conducted these interviews between February 10, 2021, and February 24,

2021. I coded and analyzed the 24 questionnaire respondents' input, and I used a maximal variation sampling methodology to select six participants to interview. Since one of these participants was not able to participate in this stage (or the next stage) of the data collection process, five participants were interviewed. Due to the COVID-19 pandemic's social distancing constraints, I remotely conducted these participant interviews using Zoom. These interviews were coded and analyzed according to emergent themes for the purpose of generating assertions in a manner consistent with case study design (Creswell and Poth, 2018, p. 282).

The third data collection stage used open-ended sentence stems to garner typed responses from this study's five participants. I administered and collected these data between March 2, 2021, and March 5, 2021. These responses built a more "in-depth picture" (Creswell & Poth, 2018, p. 162) of this study's case by allowing participants to revisit the first data collection stage's written medium. Also, these open-ended responses revisited or extended subject matter from the second data collection stage's interviews. After I coded and analyzed the five participants' semi-structured interview transcripts, these open-ended sentence stems further elicited participants' perceptions of impacts to students' communication and social skills following the district's 1:1 implementation.

This study collected and triangulated three forms of data, in three stages, to craft a comprehensive understanding of a developing subject area. One-to-one initiatives yield complex consequences for both teachers and students, and this study's data collection procedures endeavored to make sense of these consequences. Though this study's data collection procedures focused on a single case, this case encompasses multiple

perspectives to elucidate a holistic, nuanced portrait of teachers' perceptions of a 1:1 implementation's impacts on students' communication and social skills.

### *Data Analysis*

I analyzed this study's data in three stages. In the first stage, I analyzed data collected from 24 teachers' questionnaire responses. Then, I generated emergent themes. In the second stage, I analyzed data collected from five teacher participants' semi-structured interviews. In the third stage, I used the five participants as embedded units of analysis: I analyzed data collected from these five participants' open-ended responses, and I compared these data to data collected from their previous questionnaire responses and semi-structured interviews. Then, I generated more emergent themes. The following paragraphs enumerate the data analysis process within each of these stages.

In the first data analysis stage, I coded the 24 teachers' questionnaire responses using first cycle, qualitative coding strategies (Saldaña, 2009, p. 46) to familiarize myself with the data. Then, I coded these responses a second and a third time using post priori, second cycle coding methods (p. 46). In particular, I recognized patterned variation in the data: though the questionnaire respondents typed responses focused on similar subject matter, these teachers' "individual value, attitude, and belief systems" (p. 6) regarding the district's 1:1 implementation varied. After I coded the questionnaire data, themes emerged (Creswell & Poth, 2018, p. 194). To choose this study's participants, I analyzed these themes. Then, I concluded the first stage of data analysis by interpreting these themes, "abstracting out beyond the codes and themes to the larger meaning of the data" (p. 195), and by applying these meanings to participant interview questions.

In the second data analysis stage, I coded and analyzed the five participants' interviews using first and second cycle, post priori coding (Saldaña, 2009, p. 46) to develop emergent themes (Creswell & Poth, 2018, p. 194). I compared these themes to those elicited after the first stage, noting similarities and differences. Collectively, these themes, similarities, and differences informed the questions comprising the open-ended sentence stem responses these five participants subsequently provided.

In the third data analysis stage, I coded and analyzed the five participants' open-ended responses using first and second cycle, post priori coding (Saldaña, 2009, p. 46). I compared these responses to participants' interview question answers and participants' initial questionnaire responses. From these comparisons, new themes emerged. To generate assertions consistent with case study research design procedures (Creswell & Poth, 2018, p. 282) and ultimately answer this study's research question, I interpreted these themes using each of this study's five participants as embedded units of analysis.

#### *Data Validation*

This study utilized several validity procedures for its findings. Creswell and Creswell (2018) recommend doing so, as this practice "should enhance the researcher's ability to assess the accuracy of findings as well as convince readers of that accuracy" (p. 200). The first of these procedures was triangulation. This study triangulates 24 teachers' questionnaire responses with five participants' interview transcripts and open-ended responses to uncover themes and answer this study's research question. The second data validation procedure within this study is the thick, rich descriptive prosal strategy recommended by Creswell and Creswell (2018, p. 200) to convey the researcher's findings. This study's third and perhaps most important data validation procedure is its

presentation of “negative or discrepant information that runs counter to the themes” (p. 201). Such presentation was organic: some of the five participants—alongside many questionnaire respondents—found little, if any changes (or, ultimately, impacts) to students’ communication and social skills following the district’s 1:1 implementation. These accounts do not diminish this study’s findings, rather, they strengthen these results.

### *Limitations and Delimitations*

This study has four limitations. The first of these limitations concerns institutional pressures on this study’s findings. By virtue of the 1:1 implementation’s assumed costs and evident scope, teachers may have felt pressured to speak to their employer’s successes. Also, since I needed the SCRHS principal to forward this study’s initial questionnaire to SCRHS teaching faculty, it is possible that some teachers felt unnecessarily compelled to participate.

This study’s second limitation concerns its sampling. This study’s maximal variation sampling methodology purposefully elicited a wide spectrum of teachers’ observations of the 1:1 implementation’s impacts on students’ communication and social skills. This approach to data collection and analysis asks that such variation not be interpreted as popularity metrics. This study’s five participants—culled from 24 questionnaire respondents—do not represent all SCRHS teachers’ perspectives.

This study’s third limitation concerns its nonacademic focus. Though this study did not examine the 1:1 implementation’s academic implications, teachers were asked about students’ communication and social skills in what were often explicitly academic contexts. In this sense, it is possible that teachers—consciously or unconsciously—commented on impacts to students’ academic performances, rather than impacts to

students' communication or social skills. Similarly, while impacts to students' communication and social skills were not associated with negative pedagogical or learning implications, teachers may have—consciously or unconsciously—associated the 1:1 implementation's positive or negative impacts to students' communication and social skills with their own abilities to integrate the district-issued devices into their classes.

This study's fourth limitation is its most significant: the COVID-19 Pandemic's incalculable effects on teachers and students. Though I started writing this study in 2018, students had yet to return to fully in-person instruction when this study's data were collected, . While this study's subject matter remains relevant to the myriad, emergent, post-pandemic, hybrid and fully remote learning contexts, these pivots were too engrossing, too monumental, too unpredictable, and too sudden to be reflected in this study's research design.

This study's delimitation concerns the COVID-19 Pandemic. I consistently clarified to questionnaire respondents and study participants that this study focused on school as it was before this pandemic, not as it transpired since this pandemic's onset. Nonetheless, while respondents and participants did not often digress into their post-pandemic educational dynamics, this pandemic's effects weighed on all teachers' minds. As a result, every effort was made to keep this study's focus on teachers' pre-pandemic educational reality.

### *Ethical Considerations*

Ethical considerations are made throughout this study. The Institutional Review Board (IRB) stipulated in an email, on July 23rd, 2020, that this study does not qualify as human subjects research. Participants are anonymized using pseudonyms and data

protection protocols are deployed in all stages of data collection and analysis to protect participants' privacy. The researcher's (my) positionality; I am a teacher within the SCRSD, the district in which this study takes place. Two overarching truths insulate this study from a theoretical conflict of interest that could arise from my position. First, while I am a district employee, I have spent the seven years of my SCRSD teaching career at SCRHS, the district's other high school. As a result, I am not familiar with any more than a few teachers—the participants of this study—at SCRHS. Those few teachers with whom I enjoy a working relationship are excluded from sampling and, as a result, participation. Second, I am a tenured teacher and longtime member of my local teachers' union, the New Jersey Education Association. Accordingly, I enjoy some degree of protection from undue administrative influence.

In addition to these primary ethical considerations, a secondary ethical consideration that insulates this study is the nature of its research question. As the SCRSD has invested in devices, digital and physical infrastructure, and technology-focused personnel, administrators might reasonably wish that any prospective research studies focusing on the district's 1:1 initiative yield desirable outcomes. Fortunately, this study does not seek to evaluate desirable or undesirable outcomes. This study does not seek to discover student or teacher satisfaction with regard to the 1:1 initiative. This study seeks to discover how 1:1 implementations impact students' social experiences.

### *Conclusion*

This qualitative, bounded, and instrumental case study examines teachers' perceptions of social impacts wrought by 1:1 student-to-device implementation. This study's results carry implications for how teachers process educational technology

initiatives, how teachers' perspectives of students' device use compares to students' device use as measured by software, and—perhaps most importantly—how educational technology deployments affect students' social behavior once devices are issued to all students. To these ends, the following chapter examines results and discusses the implications of the research findings.

## CHAPTER FOUR

### Results

#### *Introduction*

As K–12 classrooms become technologically immersive, it remains important to study the ways that teachers and students interact with one another physically, as well as digitally. These interactions merit critical research to the same extent as educational technology-driven pedagogical and educational changes. Those closest and best equipped to elucidate said changes are teachers. This study honors the veracity of their professional perspectives by answering this study’s research question using qualitative data generated from these teachers’ sensemaking.

Though this study did not evaluate teachers’ pedagogy, the TPACK conceptual framework (Mishra & Koehler, 2006, p. 1023) usefully frames teachers’ regard for the district-issued laptops’ impacts to students’ communication and social skills within this study. Perhaps obviously, blending any “new technology or new medium for teaching suddenly forces us to confront basic educational issues” (p. 1030). Here, these “educational issues” are students’ communication and social skills. Still: examining teachers’ observations of changes to students also helps teachers understand their craft in this moment of nearly incalculable technological flux.

If TPACK aims to blend its comprising knowledge domains and compile these to build an evolving framework for teaching and learning, “the rapid rate of evolution of these new digital technologies” (p. 1023) necessitates eliciting teachers’ emergent understandings. This is particularly important when the frenetic pace of such drastic

changes so profoundly affect teachers' most beloved cadre: their students. Since building TPACK means "teachers will have to do more than simply learn to use currently available tools; they will have to learn new techniques and skills as current technologies become obsolete" (p. 1023), these understandings begin with soliciting, eliciting, analyzing, and—perhaps most importantly—*trusting* teachers' observational prowess. As educational technology becomes a more poignant buzzword, an (even more) lucrative industry, and a (still more) powerful lobby, teacher voices must be studied.

With this framework as a guide, this research study sought to answer the following research question: what impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program?

To answer this question, I collected data using three tools: a questionnaire, semi-structured participant interviews, and an open-ended sentence stem response form. Qualitative research studies usually include several data forms (Creswell & Creswell, 2018, p. 181), and each of these are used purposefully in this study. First, I sent the questionnaire (developed for this study) to all eligible teaching faculty members at SCRHS. As a qualitative document, the questionnaire sought "to obtain the language and words of participants" (p. 188). Then, I analyzed these teachers' responses using pattern matching and post-priori coding methods to elicit both the data's emergent themes and the five teachers with whom I conducted semi-structured interviews. After I conducted interviews with these five participants, I transcribed, coded, and analyzed their responses. Interviews allow qualitative researchers to focus data collection on targeted topics and questions (p. 188), and in this study, participant interviews were opportunities to

complement participants' written responses. Using these interviews and analyses, I developed and administered to these same five participants an open-ended response form. After supplementing questionnaire responses with in-depth participant interviews, it was helpful to then balance participants' interviews with another qualitative document. Finally, after the five participants submitted their open-ended responses, I logged and analyzed these data, as well.

This study employed a qualitative, bounded, instrumental case study design with embedded units of analysis to investigate teachers' observations of students' communication and social skills following SCRS's 1:1 implementation. The "instrumental" distinction reflects this study's focus on teachers' perceptions of students' communication and social skills following the district's 1:1 implementation. This focal point is specific: this study's time (the 2020–2021 academic year), its location (SCRHS), and its subject matter (observed impacts to students' communication and social skills) were purposefully selected. In this way, the study "focuses on an issue or concern and then selects one bounded case to illustrate this issue" (p. 98), but since 1:1 initiatives occur across the world, an intrinsic case study design would not suit this study.

Since "phenomenon and context are not always distinguishable in real life situations" (Yin, 1994, p. 13) the case study research design fits this study's focus on teachers' observations of both a phenomenon (the district's 1:1 initiative), and a context (observed impacts to students). To Yin's point, the preceding sentence's distinctions are equally justifiable if inverted: the initiative as context, observed impacts to students as phenomenon. In a bounded case study, the researcher "explores a real-life, contemporary bounded system (a case) or multiple systems (cases) over time, through detailed, in-depth

data collection involving multiple sources of information [...] and reports a case description and case themes” (Creswell & Poth, 2018, p. 96). This research design was appropriate for this study because it acknowledged and embraced participants’ “*multiple realities*, the different and even contradictory views of what is happening” (Stake, 1995, p. 12). As such, this study valued participants’ contributions as distinctly important on both individual and collective bases.

Yet, this study also valued participants’ contributions in other ways: as professionals in practice with expectedly divergent experiences, competencies, and opinions—of equal merit—regarding the district-issued devices and students’ behaviors. This study’s “embedded units of analysis” were each of the five participants whose questionnaire responses, interview responses, and open-ended responses are analyzed in this chapter. These participants were “embedded units of analysis” rather than “separate cases” to center this study’s focus on teachers’ observations’ veracity and validity, regardless of their age, years teaching, or academic specialty. Since this study is neither concerned with the district-issued laptops’ pedagogical effects nor teachers’ device-related competencies, I chose to de-emphasize (via omission during data collection,) precisely the demographic differences (e.g., teachers’ ages, their years in professional practice, their academic qualifications) or occupational differences (e.g., tenured versus nontenured teachers, teachers’ professional development experiences, the extent to which teachers incorporate lessons involving the district-issued laptops) rendering one teacher’s opinion as weightier than a teacher’s colleague.

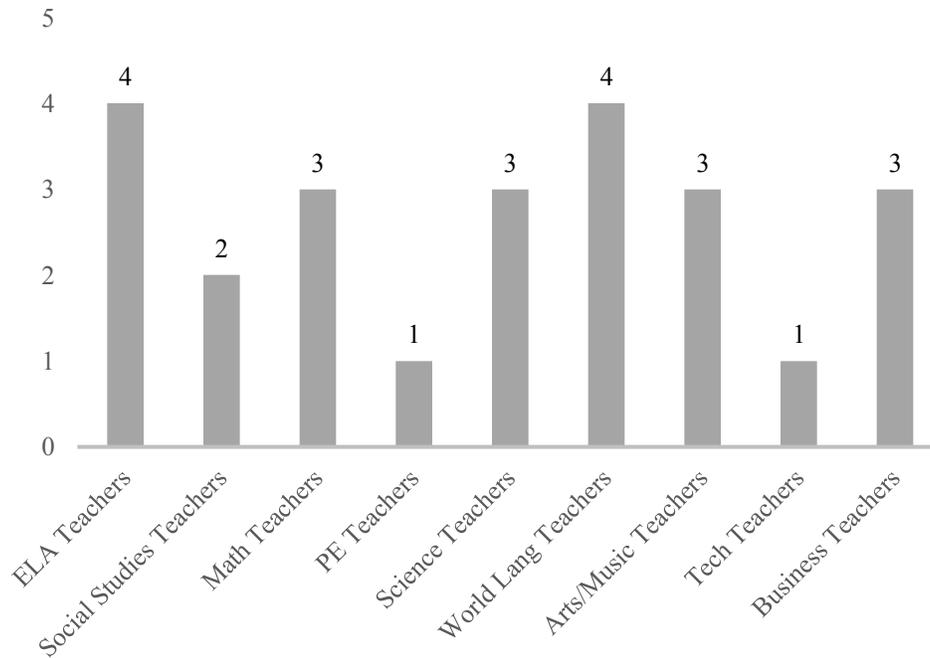
This chapter presents this study’s findings according to the following format: first, this chapter discusses the 24 questionnaire respondents’ responses. Next, this chapter

discusses these responses' emergent themes. Following this discussion, I summarize how these questionnaire responses and themes were used to select this study's five principal participants.

After discussing the questionnaire, I present this study's five principal participants as embedded units of analysis within this bounded case study. I present each participant according to the following template: first, I provide an overview of his or her questionnaire responses. Second, I provide an overview of his or her answers to the interview questions. Third, I analyze each participant's responses to each of the interview questions. Fourth, I provide an overview of each participant's open-ended sentence stems. Fifth, I use each participant as an embedded unit of analysis to answer this study's research question.

### *Questionnaire Results*

The first stage of this study's data collection process utilized a digital questionnaire. I administered this questionnaire using Microsoft Forms. I collected and stored responses on my Baylor University cloud-based account. I emailed the questionnaire to SCRHS faculty members along with this study's eligibility requirements, an explanation of the study's scope and foci, and a consent form. During this first data collection stage, several reminders were sent to SCRHS faculty members to encourage further participation. At this data collection stage's conclusion, Figure 4.1 shows the 24 respondents, spanning many academic departments.



*Figure 4.1.* Questionnaire respondents by academic department.

The questionnaire comprised four questions. These questions sought to understand teachers’ perceptions of students’ social experiences within a 1:1 implementation by asking teachers to recount any changes regarding students’ communication or social experiences since the implementation’s outset. The first question asked, “BEFORE the onset of the COVID-19 pandemic, what changes did you observe IN YOUR CLASSROOM or INSTRUCTIONAL SPACE regarding your students’ communication and social skills since the 1:1 device program’s\* implementation in 2017-2018?” Beneath this question, I included a working definition of the “1:1 device program,” indicated by an asterisk: “\* ‘1:1 device program’ refers to the district issuing one laptop to each student at a 1:1 ratio.” The second question asked, “BEFORE the onset of the COVID-19 pandemic, what changes did you observe regarding your students’ communication and social skills in the school’s PUBLIC

AREAS (e.g., hallways, library, cafeteria) since the 1:1 device program’s implementation beginning in 2017-2018?” The third question asked, “Based on your observations, what are the 1:1 device program’s overall effects (if any) on the quality or nature of students’ social interactions and communications?” The fourth question asked, “Is there anything else you’d like to write about 1:1 learning and students’ communications or socialization?” Participants were required to respond to the first three questions, but a response to the fourth question was optional. Participants’ question four responses were too varied, off-topic, or open-ended to be useful. These are not included in this study.

### *Question One*

The questionnaire’s first question asked for teachers’ observations of students’ post-1:1 implementation behavior and social skills within traditional classroom contexts. The first question was as follows: “BEFORE the onset of the COVID-19 pandemic, what changes did you observe IN YOUR CLASSROOM or INSTRUCTIONAL SPACE regarding your students’ communication and social skills since the 1:1 device program’s\* implementation in 2017-2018?” \* “1:1 device program” refers to the district issuing one laptop to each student at a 1:1 ratio.

Table 4.1 shows that—of the 24 respondents—10 observed some change in students’ communication or socialization in the respondents’ primary instructional spaces. Likewise, 10 respondents observed negligible or no changes, in the way that students communicated or socialized in teachers’ instructional spaces. I omitted the four remaining responses, as these constituted either “n/a” or off-topic narratives that did not address the question.

Table 4.1

*Question One: Observed Changes in Primary Instructional Spaces*

Total Respondents	Observed Changes	Changes Not Observed	Off-Topic or N/A
24	10	10	4

Table 4.2 shows that—of the 10 respondents who indicated a change in the quality or nature of students’ social interactions or communications in instructional spaces—no respondents regarded such changes as positive or neutral in their nature. Therefore, all 10 respondents indicating a change in the quality or nature of students’ social interactions or communications in instructional spaces regarded these changes as negative in nature.

Table 4.2

*Question One: Nature of Changes in Primary Instructional Spaces*

Total Respondents Indicating Change	Positive Changes	Negative Changes	Neutral Changes
10	0	10	0

Since the questionnaire (purposefully) avoided defining the terms “communication” and “social skills,” I coded those practices and behaviors that teachers included in their answers to each question. In response to the first question, these participant-defined components of students’ communication and social skills within instructional spaces were “organizational skills,” “eye contact,” “discussion,” “interaction,” “patience,” and one’s ability to “communicate verbally.”

*Question Two*

The questionnaire’s second question asked for teachers’ observations of students’ post-1:1 implementation behavior and social skills outside of the traditional classroom. Since students use the district-issued laptops throughout the school, it was important to figure out how students used devices outside of a formal, academic context. The second question was as follows: “BEFORE the onset of the COVID-19 pandemic, what changes did you observe regarding your students’ communication and social skills in the school’s PUBLIC AREAS (e.g., hallways, library, cafeteria) since the 1:1 device program’s implementation beginning in 2017–2018?”

Table 4.3 shows that—of the 24 respondents—12 observed some change in students’ communication or socialization in the school’s public areas. Alternatively, eight respondents observed negligible or no changes in the way that students communicated or socialized in the school’s public areas. I omitted the four remaining responses, as these constituted either “n/a” or off-topic narratives that did not address the question.

Table 4.3

*Question Two: Observed Changes in Social Spaces*

Total Respondents	Observed Changes	Changes Not Observed	Off-Topic or N/A
24	12	8	4

Table 4.4 shows that—of the 12 respondents who indicated a change in the quality or nature of students’ social interactions or communications in the school’s public areas—no respondents regarded such changes as positive in their nature. One response was coded as neutral, while the remaining 11 respondents indicating a change in the

quality or nature of students’ social interactions or communications in the school’s public areas regarded these changes as negative in nature.

Table 4.4

*Question Two: Nature of Changes in Social Spaces*

Total Respondents Indicating Change	Positive Changes	Negative Changes	Neutral Changes
12	0	11	1

Since the questionnaire (purposefully) avoided defining the terms “communication” and “social skills,” I coded those practices and behaviors that teachers included in their answers to each question. In response to the second question, these participant-defined components of students’ communication and social skills in the school’s public areas were “talking” (to a peer or to a group of peers), “eye contact” (i.e., not “looking down” at personal or district-issued devices), “engaged conversation,” and “interacting” with students’ peers in close proximity.

*Question Three*

The third question asked about teachers’ overarching observations, irrespective of these observations’ contexts. This question was as follows: “Based on your observations, what are the 1:1 device program’s overall effects (if any) on the quality or nature of students’ social interactions and communications?”

Table 4.5 shows that—of the 24 respondents—14 detailed some overall change in students’ communication or socialization since the 1:1 implementation’s outset.

Alternatively, eight respondents observed negligible or no overall changes to students’

communication or socialization. I omitted the two remaining responses, as these constituted either “n/a” or off-topic narratives that did not address the question.

Table 4.5

*Question Three: Overall Observed Changes*

Total Respondents	Observed Changes	Changes Not Observed	Off-Topic or N/A
24	14	8	2

Table 4.6 shows that—of the 14 respondents who indicated a change in the quality or nature of students’ overall social interactions or communications—one respondent regarded such changes as positive in their nature. Three responses were coded as neutral, while the remaining 10 respondents indicating a change in the overall quality or nature of students’ social interactions or communications in the school’s public areas regarded these changes as negative in nature.

Table 4.6

*Question Three: Overall Nature of Changes*

Total Respondents Indicating Change	Positive Changes	Negative Changes	Neutral Changes
14	1	10	3

Since the questionnaire (purposefully) avoided defining the terms “communication” and “social skills,” I coded those practices and behaviors that teachers included in their answers to each question. In response to the third question, these participant-defined components of students’ overall communication and social skills were “discussion,” “interaction,” the ability to “listen to other people’s contributions to the

class setting,” “eye contact,” “undivided attention,” “conversation,” “collaboration,” “verbal communication,” and “written communication.”

### *Questionnaire Results: Emergent Themes*

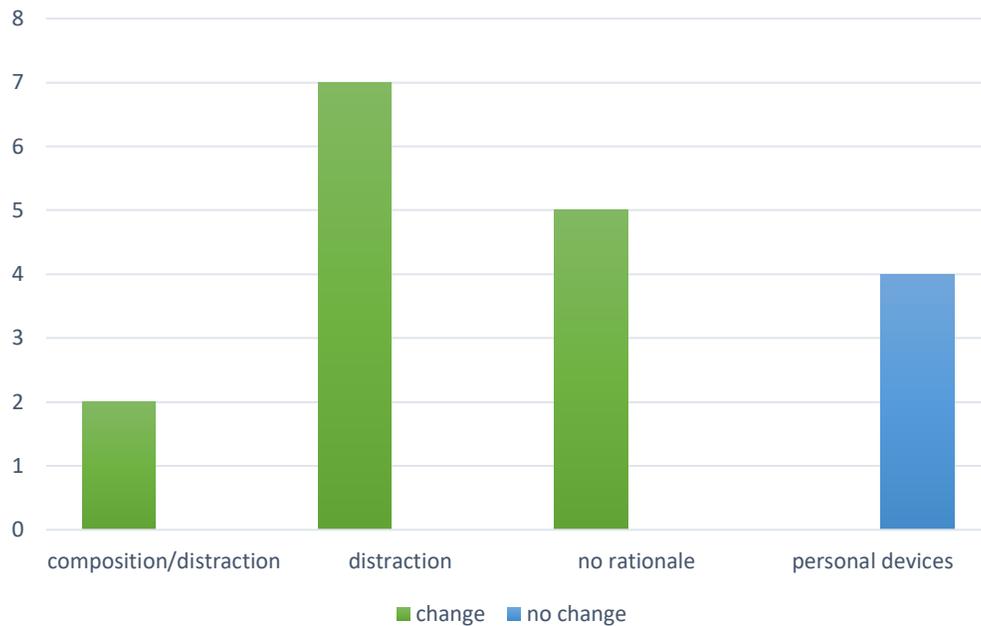
After analyzing this study’s questionnaire responses, I coded these responses into emergent themes. Questionnaire respondents’ two, foremost themes are explained in this section. First, I explain the teachers’ concerns regarding students’ personal device use. Then, I explain the teachers’ perceptions of students’ distraction, students’ disengagement, how students used devices to hide during classes, and how students withdrew from interpersonal contexts.

#### *Personal Device Concerns*

Students’ personal device use permeated teachers’ observed changes to students’ communication and social skills since the 1:1 implementation’s launch. Though none of the questionnaire’s questions asked about students’ use of personal devices (e.g., cell phones, tablets, personal laptops), many teachers, nonetheless, commented on students’ personal device use as it relates to students’ social behaviors and communications. Of the 24 participants’ 72 responses to the first three questions, 18 responses referenced students’ cell phone use or personal electronic device use. Three participants mentioned cell phone or personal device use in response to question one, nine participants broached the topic in response to question two, and six participants mentioned these devices in response to question three.

Of these 18 responses, spanning all three questions on the questionnaire, four responses were previously coded as those indicating no change to students’ communication and social skills. Alternatively, 14 of these were previously coded as

responses indicating changes to students’ communication and social skills. Within these 14 responses indicating changes, two primarily focused on both students’ personal device use as a distraction and students’ personal device use as affecting academic compositions. Seven responses primarily described students’ personal device use (i.e., cell phone use) as distracting to peers or teachers.



*Figure 4.2.* Participant responses referencing students’ personal devices.

Two of these seven responses were responses to the questionnaire’s first question. These two responses indicated that, within primary instructional spaces, students’ distraction took the form of both unsanctioned digital communication and its inverse: communication’s absence at both the peer-to-peer and student-to-teacher levels. Nadine’s response to question one spoke to this juxtaposition, to Nadine’s perception of students’ use of district-issued devices, and to her students’ communication and social skills.

I noticed that students would use the Chromebook screen to hide their cell phones from view and participate less and less in class. Those students

were “communicating” with other students via handheld devices more. However, I also found students who were blatantly surfing the internet, neither participating in class, nor communicating with other students and those students were completely shut off from any social interactions.

In this response, Nadine’s perception of the 1:1 student-to-device implementation’s impact on students’ social experiences was complex. She recognized both distraction via communication and distraction via the absence of communication. Nadine perhaps tacitly recognized the power of students’ electronic communication channels by virtue of her recognition that students were, indeed, “communicating” via “handheld devices.” At the same time, her use of the adverb “blatantly” implied that she perceived her students consciously rejecting in-person communication. Still, Nadine’s following that sentiment with “students were completely shut off from any social interactions” indicated complexity: Nadine valued both students’ social skills and communication skills because she lamented their diminishment. However, she clearly preferred that these skills develop physically rather than electronically, and she regarded students’ digital communications—those presumed to be unrelated to class proceedings—as agents of communication and social skills diminishment.

The remaining five responses indicating students’ personal devices’ distraction—of the seven who observed changes—addressed the questionnaire’s second question. These responses described how students’ personal device use in the school’s social spaces distracts them from potential conversations or interactions in students’ physical vicinity. The teachers’ observations depicted students’ interactions in the school’s hallways, its library, its cafeteria, and other communal spaces.

Such distraction was marked by diminished eye contact toward peers, diminished attention paid to peers, diminished conversation levels, and diminished engagement

during verbal conversations at the expense of students' personal device use. Norma detailed many of these observations when she described how students' personal device use impacted their communication and social skills in public spaces.

While students did talk in the hallways, it seemed to be less engaged conversation, and more superficial greetings or goofing around. Students would often be texting while walking and seem disengaged with the group of students around them. This behavior escalated once students were permitted to openly carry their phones in the hallways.

Notably, her question two response omits any mention of the 1:1 implementation and its associated laptops. This omission, combined with her substituted focus on students' personal devices in lieu of the district-issued devices, connoted her understanding all devices as distracting from students' physical presence. Norma's reference to students' "permission" to use devices in the school's public spaces "openly" tacitly suggests her preference for institutional prohibition of students' personal device use. Like Nadine's perspective, Norma's is also complex. Her substitution of students' personal devices for the district-issued devices, coupled with her portrayal of students' changed communication and social behaviors, suggest her perception of these changes is negative. However, by omitting the district-issued devices, she importantly does not attribute the students' changed behaviors to the 1:1 implementation.

Two participant responses mentioned students' personal device use, observed changes in students' communication and social skills since 1:1 implementation, and considered personal device use to be both a distraction (as other participants noted) and catalysts for changes in students' composition. Since these were both responses to question three, they came from two different teachers. Both responses compared the district-issued laptops to personal devices, and both responses perceived the 1:1

implementation's impacts on students' communication and social skills as complex: expedient or convenient as a compositional tool or communication medium, but perhaps detrimental to social skills development.

Audrey's response was compelling. She highlighted how disparate expectations within intersectional physical, digital, social, and academic paradigms creates confusion in students' behaviors and scholastic output.

I appreciate the numerous benefits of technology, but I feel that students are more isolated because of it. There's more of a focus on needing to appear a certain way on their apps, they become distracted even when interacting among their peers. Basic social skills are not as well-practiced when everything is submitted electronically. Written work has more grammatical errors because it's as if some students type their work like they are texting their friends. From a different perspective, in some respects, I have had several students who are not comfortable speaking aloud in class, but they are very comfortable writing/typing.

Audrey illustrated a complex portrait of 1:1 implementation's impacts on students' communication and social skills. Students prioritized digital communication over physical communication in her classroom—what are traditionally physically social situations—but they carry these digital preferences into their academic compositions without ample nuance. Importantly, Audrey indicated that this dynamic does work toward some students' benefit. The extent to which Audrey perceived these students' benefits as helpful or detrimental to communication and social skills was unclear.

Judy was the other respondent who observed changes to students' communication and social skills since the 1:1 implementation, and who also considered personal device use to be both a distraction and catalyst for changes in students' composition within the 1:1 implementation. Her response was also compelling. Judy's response aligned with Audrey's recognition of both students' diminished communication skills within academic

compositions and her perception of students' increased preference for solitude, conscious or not.

Students are more comfortable with informal, written forms of communication than with verbal communication. (This is not to say that their written communication is better than it used to be – only that it isn't as “scary” for them.) They now will sit next to each other and text each other, rather than turning to each other and having a conversation. I also think this is leading to increased anxiety – both social anxiety (who knows what that person over there is texting??? Are they laughing about me?), and performance anxiety when they are forced to actually communicate verbally. I think it also limits the social interactions students have – their ability to interact with people they wouldn't normally interact with. When you can just text your friend in another class, why do you need to branch out and meet the kid you don't know who is sitting next to you? And if you can't hear a conversation between two classmates because it is being conducted via chat/text, how can you join in?

Judy's response was also complex. Her response diverges from Audrey's in that Judy postulated students' increased isolation as a self-perpetuating phenomenon aided by device use. She did not distinguish district-issued devices from personal devices. She suggested the diminished vocal communication in her class made her students less familiar with such communication, and as students become less familiar with it, such verbal communication seems less normal. Though less explicitly than Audrey, Judy also alluded to students' “medium confusion” in their movement between physical and digital communications in school. While Judy indicated her students' preference for “informal, written forms of communication” as opposed to “verbal” communication, she made it clear that her students' preferences have not led to higher-quality written communications.

Five responses previously coded to indicate changes to students' communication and social skills since 1:1 implementation also mentioned students' personal device use, but did not offer “distraction” as an impact. These five responses further developed the

personal device use theme, but they were less cohesive in their omission of rationale. Still, these responses were cohesive in some senses; they were nearly unanimous (if to disparate extents) in their perception that changes to students' communication and social skills were negative in nature.

Nonetheless, these responses portrayed the complexity of the teachers' perceptions of personal device use and district-issued device use impacts. For instance, James's response suggested that it was "only" students' cell phone use that changed social skills, however, he did not specify the nature of these changes. The presence of "only" in this response suggests he did not mean the district-issued devices, but he did not elaborate on this. Dale's perception of the changes to students' communication and social skills acknowledged the district-issued devices' role in the process. He responded that any degree of change "trends more negatively than positively. Again, I do believe that this trend started earlier with the rise of smart phones in particular. The 1:1 has simply accelerated markedly the trend." Shelley's response concurred with Dale's perception of changes as negative, but she was milder than both James and Dale in abstaining from assigning cause to district-issued devices or cell phones.

I feel that there is a negative effect on the quality or nature of students' social interactions and communications. However, I am not convinced that this is due to the district's 1:1 initiative or the increase in cellphone and technology use in general.

Though Shelley agreed with James's perception of changes to students' communication and social skills, she distinguished these changes as negative in nature. Still, she did not go so far as to assign a catalyst or rationale (e.g., students' personal device use, their district-issued device use, school administrators' newly permissive attitudes toward both) for these changes as James was compelled to do.

Whether—or to what extent—one could pinpoint students’ devices or district-issued devices as changing students’ communication and social skills was not debatable to all respondents. Gordon’s response differed from the other four respondents in his refusal to be drawn on assigning cause or blame. Gordon somewhat agreed with James’s perception that cell phones impacted students’ communication and social skills, and he also agreed with both Dale’s and Shelley’s categorizing these changes as mostly negative. However, Gordon contended that distinctions between electronic devices—personal or district-issued—are superfluous, as students regard all devices similarly.

While I understand the question is referring to 1 to 1 implementation, I don’t think it is mutually exclusive from cell phone use. Students don’t see the difference between them. So the biggest difference I see in social areas is a lack of communication between students and consequently a serious decline in social skills.

These five responses were neither bound by the “distraction” sub-theme nor a link to students’ in-class composition and communication as the previous five and two responses, respectively, were bound to one another in coding analysis. Yet, these latter five all acknowledged students’ personal devices as playing some kind of role in changes to students’ communication and social skills.

Four responses previously coded as those who did not observe a change in students’ communication and social skills mentioned students’ use of mobile devices as well. These four responses represented four different teachers. Three of these attributed changes to students’ communication and social skills to the presence of personal devices, while a fourth seemed to directly equivocate the students’ personal devices with the district-issued laptops, noting the former is “socially no different than a phone.”

These responses perhaps suggested the limitations of questionnaires as lone data collection instruments. Interestingly, while some of the responses that indicated changes to students' communication and social skills insisted that such changes were at least partially attributed to both students' personal devices and the district-issued devices, these respondents provided similar rationales as evidence for why changes had not taken place. While the open-ended nature of the questionnaire's construction allowed data collection trends and themes to develop organically rather than, for instance, around an established survey instrument's predisposed understandings, distinguishing responses' intent in sorting or coding was difficult at times. Such difficulties manifested when responses indicating "change" attributed such changes as pre-dating the 1:1 implementation while other respondents attributed "no change" to perceived "changes" as pre-dating the 1:1 implementation as well.

#### *Distraction, Disengagement, Hiding, and Withdrawal from Interpersonal Contexts*

Across all three of the questionnaire's questions, some teachers described how their students became more frequently distracted or disengaged following the district's 1:1 implementation. In response to the first question (regarding observed changes in teachers' primary instructional spaces), three teachers used the terms "distraction" or "distracted." Norma was one of these teachers. Norma implied the devices distracted students by shifting their focus from their teacher to the devices. She directly attributed such distractions to students' "devices," and detailed such distraction's evidence by noting that students "were less likely to engage in direct eye contact and communication unless told to close or put away their devices." In this sense, though Norma did not

clarify whether she explicitly meant the district-issued laptops or to students' personal devices, she attributed the devices' presence (as opposed to their use) as distracting.

Other teachers noted how the laptops distracted students while these devices were in use. Margaret described how students struggled to adequately shift their focus between the computers and interpersonal interaction. While she noted students' sincere interest in their devices, it became difficult for her to discern when students were on task, as "it became very easy to pretend to be working on coursework." Audrey echoed these sentiments when she explained how students show "more distraction with viewing other tabs when they should be focused in class or doing individual/group activities." In Margaret's classes, "students had to be reminded to come back to the class discussions and stop viewing what they were viewing." Here, Margaret's and Audrey's descriptions of students' distractions lend two classroom contexts to Norma's descriptions: student-to-device distractions (i.e., when students struggle to authentically focus on academic tasks), and student-to-student distractions (i.e., when students struggle to return their focus from their devices to their classmates).

While only Norma, Margaret, and Audrey explicitly used the terms "distracted" and "distraction," several teachers arguably went further to describe how students willfully avoided engaging with content, peers, or their teachers. Both Nadine and Josie described how students disengaged via "hiding" behind their computer screens. Nadine observed her students using their laptops "to hide their cell phones from view and participate less and less in class," while "blatantly surfing the internet, neither participating in class, nor communicating with other students." Josie described how her

students were “physically hiding behind the screen” as well. Nadine lamented how these “hiding” students were “completely shut off from any social interactions.”

Such depictions of distraction and avoidance suggested teachers believed students’ social experiences diminished in quality and frequency since the district’s 1:1 implementation. Andy detailed how students are “absorbed by their computer,” and since they “spent less time interacting with classmates, [they became] less likely to answer questions in a group setting.” Though Tammy was “not sure if it is due to the 1:1 initiative at school or the rise in cellphone use in general,” she was certain that students “are definitely more removed from personal social interactions.” Dale was similarly unsure if it was fair to attribute his observations of students’ changes to the 1:1 implementation or students’ increased personal device use. He believed students’ diminished “organizational skills, communication skills, and social skills” predated the district-issued laptops, but could not pinpoint whether their introduction had an effect.

Some teachers linked students’ more infrequent, less preferential social interactions to increased public reticence in what were formerly interpersonal, social scenarios. These teachers commented on students’ altered desire and ability to engage their academic subject matter, their peers in social situations, their classes’ group dynamics, and their personal down time. Tammy, Gordon, and Judy exemplified how students’ technology engagement preference does not transpire in a vacuum.

When students look to their computers or phones, they look away from something—or, more likely, someone—else. Tammy observed her students’ patience lessened dramatically; she explained how “if there is a lull in teaching material, they are on their phone.” Both Gordon and Judy took Tammy’s “teaching lull” frustrations

further. They suggested students' increasing preference for device engagement in what were formerly social classroom situations come at the expense of formerly rewarding, impromptu student-to-student relationships. Gordon vividly depicted how these changes affected students' down time:

One notable difference I see is how students handle down time. In the past students would finish an assignment and then move to help a peer. Now students are more 'selfish' in that once they are done with their own work they will move to something else they need to get down, play a game on their device, or view social media. I also distinctly remember times when students would play cards in my class whenever a test had concluded or we had some extra time to kill. They would foster relationships with their peers that I seldom see nowadays.

Here, Gordon lamented neither students' increased screen time nor observations of diminished skills: he lamented incalculable, unquantifiable missed opportunities.

Though Gordon's response recalled finite behaviors, he implied subtle, yet profound, changes to students' social lives transpiring at school: declining meaningfulness and connection and waning interpersonal spontaneity, albeit in exchange for a more nakedly selfish, if more productive reality. Judy illustrated how this concept calcified: each time students opted to connect with their devices instead of their classmates, they perpetuate growing discomfort with interpersonal relationships in school. She recalled how students—"whether it was on-task [...] or off-task"—socialized more frequently before the 1:1 implementation. Since then, she explained how students instead used their computers for games when possible. Judy hypothesized how students' device preferences in these moments may, en masse, signify complex consequences regarding students' communication and social skills.

Possibly coincidentally (but probably not...), I also noticed a significant increase in the amount of anxiety students demonstrated with speaking in front of the class around the same time that these changes were occurring.

It's only a hypothesis, but my guess is that as they became less used to socializing and interacting with their classmates, they became less cohesive as a class (it's scarier to talk in front of people you don't know as well). It also may be that they just became less able to communicate verbally, and the lack of skills in this area led to the anxiety.

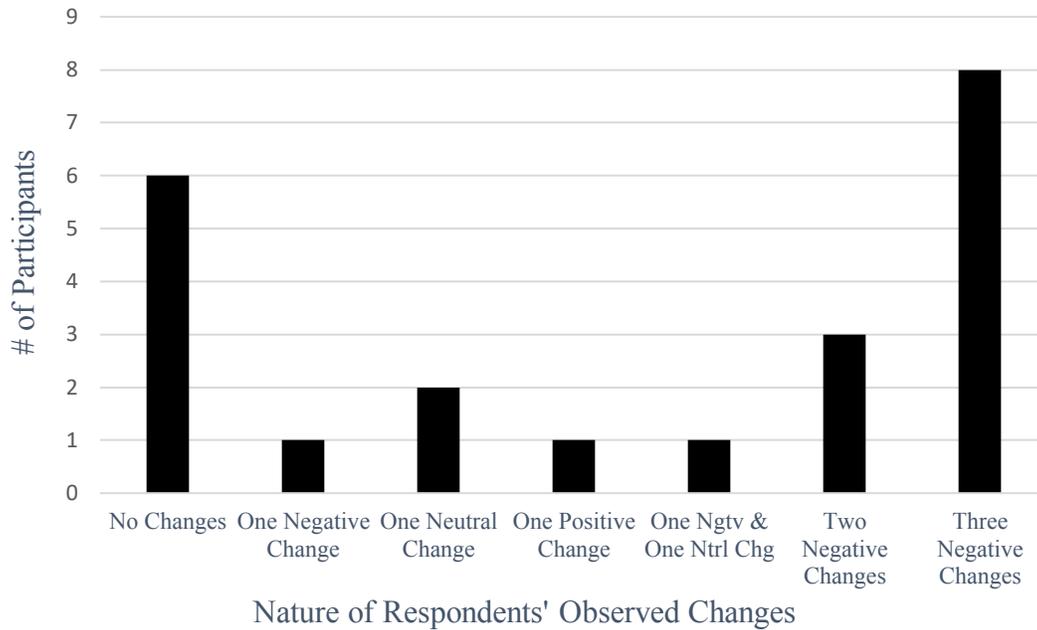
Tammy's concerns regarding her students' patience, Gordon's pre- versus post-1:1 implementation comparison, and Judy's closing hypothesis portrayed students pulled away. They illustrated a shared thematic sense that—even while devices academically enhance productivity—students' devices detracted from traditional classroom stimuli: students, a teacher, subject matter, and the interactions between these parties. Alongside shared observations and concerns regarding students' personal device use, many teachers' questionnaire responses coalesced around newly complex classroom dynamics: how distracted students hid, disengaged, and withdrew from traditionally communicative and social contexts at unknown expense.

### *Participants*

After coding and analyzing the 24 questionnaire respondents' responses and explicating emergent themes, I targeted six of the 24 participants as semi-structured interview participants and—following these interviews' conclusions—open-ended response recipients. In sampling prospective participants for these data collection streams, I chose a maximal variation (or maximum variation) approach to represent the diverse range of questionnaire respondents' perspectives. Qualitative case studies utilize maximum variation sampling “to represent diverse cases and to fully describe multiple perspectives about the cases” (Creswell & Poth, 2018, p. 158). Rather than “cases,” though, this study situated its participants as embedded units of analysis within a single, bounded case.

Before I selected six participants, I chose three indices to ensure maximum variation among the 24 respondents' perspectives. First, I wanted to interview teachers who both observed and did not observe changes to students' communication and social skills. Second, I wanted to interview teachers who observed different kinds of changes to students' communication and social skills. Third, though this study did not assess the district-issued laptops' pedagogical merits, I wanted—to the extent it was possible following the preceding two steps—to interview teachers of different subject matter. Interviewing teachers across academic content areas was particularly important, as doing so honors this study's pragmatic lens by focusing on the reality of educational technology deployed across departments. Since such technology plays such variable roles across disciplines, ensuring input from a range of stakeholders was critical.

With these indices in focus, I accordingly analyzed participants' responses. First, I omitted two participants because their questionnaire responses were off-topic. Next, I determined whether each of the remaining 22 participants' responses to questions one, two, and three constituted observed changes to students' communication and social skills. According to these criteria, participants observed either zero, one, two, or three changes to students' communication and social skills. After I determined how many changes respondents observed, I recorded the nature of these observed changes (if present): positive, negative, or neutral. Figure 4.3 illustrates how these two metrics yielded following seven groups:



*Figure 4.3.* Respondents' observed changes to students' communication, social skills.

After I established these groups, I chose four participants: two from each of the highest populated groups: the six respondents who did not observe changes and the eight respondents who observed three negative changes. These groups' opposing perspectives also necessitated representative participants. Then, to elicit more moderate perspectives and to balance those whose responses indicated three negative changes, I chose the participant who observed a positive change and the participant who observed a neutral change to students' communication and social skills. After these participants' interviews commenced, one participant was unable to continue. This left five total participants for the remainder of the study.

The Five Participants*		
<p>“Andy” (English Language Arts) Three <i>Negative</i> Changes</p>	<p>“Jane” (Mathematics) One <i>Positive</i> Change</p>	<p><del>“Evelyn”</del> (English Language Arts) <i>No Changes</i></p>
<p>“Judy” (World Languages) Three <i>Negative</i> Changes</p>	<p>“Lucy” (World Languages) One <i>Neutral</i> Change</p>	<p>“Lawrence” (Technology) <i>No Changes</i></p>
<p>* Since Evelyn could not participate, five participants completed interviews and open-ended responses.</p>		

Figure 4.4. Study participants aligned according to data collection protocols.

This study’s five principal participants are presented as embedded units of analysis within this bounded case study. First, I provide an overview of each participant’s questionnaire responses. Second, I provide an overview of his or her answers to the interview questions. Third, I analyze each participant’s responses to the interview questions. Fourth, I provide an overview of each participant’s open-ended sentence stems. Fifth, each participant is presented as an embedded unit of analysis to answer this study’s research question.

### *Lucy*

Lucy is a world languages teacher. In her questionnaire responses, Lucy noted both a cursory, minor change and no change at all. She did not observe changes to students’ communication or social skills in her classes. She did observe such a change in

the schools' public areas, but she neither commented on this change's nature (e.g., whether it was positive, negative) nor did she regard it as an "overall" change in her following response to the third question. She noticed students no longer waited for previously scarce computer time; instead of gathering outside of the library or computer labs to socialize, "since [the district's] 1:1 [implementation], those students seem to use every free moment to take advantage of doing work and I have seen less socializing in those settings." Overall, and despite this observation, Lucy's response to the questionnaire's third question indicated she did not observe changes to students' communication and social skills.

In her interview responses, Lucy offered detailed, nuanced, and encompassing answers. Lucy defined student engagement with both specificity and flexibility, she defined students' communication skills by including intergenerational changes to the term's scope, and she defined social skills as those practiced predominantly "in-person." Lucy regarded school as a place to build the aforementioned skills, and she did not perceive students' (again, predominantly "in-person") social skills as adversely affected following the district's 1:1 implementation. She acknowledged some students' struggles to self-regulate their device use, but teachers are ultimately responsible for facilitating positive 1:1 classroom experiences for their students.

*Student engagement.* Lucy defined student engagement with both specificity in practice and a flexible understanding of its manifestation. She tacitly implied that engagement constitutes meaningful, productive work: she did not only distinguish engagement as "actively doing work." She also used the phrase, "work that benefits them." This addendum reflects a specific sense of meaning because it distinguishes

engagement as students' "actively doing work" that is pointed in a particular direction: presumably, a content- or proscribed, task-oriented direction. Lucy also understood students' engagement as innately flexible. When she said, "I don't think the way that they are getting the engagement done matters as much as what it is that they are doing," she demonstrated a tolerant perspective regarding her students' freedom to utilize the "tools or the skills" at their disposal. Finally, Lucy also acknowledged that students' engagement is demonstrated individually or collaboratively with other students.

*Communication skills.* Lucy defined students' communication skills by including intergenerational changes to the term's scope, she valued students' possession of new and diverse communication skills, and she offered a sympathetic rendering of students' proclivity for communicating well in ways that adults may not. First, Lucy noted that "this is a phrase that we've had to redefine in the last few years." She followed the initial interpretive flexibility by defining an "older generation's" understanding of students' communication skills as one that valued intimate and one-directional focus. This understanding of communication skills was one in which "you can look somebody in the eye, where you can have one-on-one engagement." This was in contrast to her rendering of students' communication skills now, when "engagement and communication" have "many different definitions." Lucy's sympathetic perception of her students' communication skills, from an intergenerational perspective, stood in contrast to several of the teachers' questionnaire responses regarding students' diminished communication skills. From Lucy's perspective, such changes were less "diminishment" and more "difference." She showed both an expectation and a tolerance for natural changes to communication skills over time.

In addition to the more traditional, one-on-one understanding of students' communication skills, Lucy specifically included electronic communication skills within her definition. She situated "being able to write an email" and "being able to communicate through a computer without being distracted" as two of her students' communications skills, with the latter distinguished as "a skill that some adults don't have, and students do." Lucy also highlighted social media skills, distanced collaboration between students in different places, and effective task delegation in group contexts as students' communication skills. When she said, "I think that kind of communication is just as important as what we valued in the past," she ultimately placed students' diverse communication skills on equal footing with traditional communication skills.

*Social skills.* Lucy defined social skills as, for the most part, the way that students interact in device-free, person-to-person contexts. She, notably, defined these alongside each other. While she conceded that "yes, there *are* social skills that happen on a device," she acknowledged the importance of "in-person" skills within social skills "because once they put the device down, they should be able to know how to speak to somebody, not in tech terms, you know?" She pointed out that—while students acquire "in-person" skills through "sports," "in life," and "in the classroom"—today's students acquire subtler, but deeply important social skills. To this end, Lucy followed familiar social skills—"learning how to be a good winner, a good loser" with a student's ability "to see a situation and react to it with empathy. I think those are social skills. [...] Our kids, we don't give them enough credit as far as how they have *gained* empathy." As evidence, she referenced theatre students' collaboration, their abilities to "work together and support one another" as important social skills.

*Should school build these skills?* Lucy defined school “100 percent” as “one of the main places” to build these skills. While she exhibited some tolerance for individual learning in school, she did not seem to go so far as to reject a school’s pivotal role in developing students’ sense of engagement, their communication skills, and their social skills. She cited perceived changes in her three-year-old daughter’s development during pre-kindergarten classes as an example of how she processes these skills’ manifestation and consequential necessity in scholastic contexts. Lucy observed that if her daughter was strictly “at home, she wouldn’t be able to develop” skills such as “sharing, even being polite to one another, showing empathy, working together in a classroom, in a sport, and so on.” Lucy’s response to this question was her most succinct and the only response not to reference her students’ behaviors as material that informs her thoughts. Perhaps since this was the fourth interview question, and thus the first to eschew the “definition” format of the preceding three, it may have invited philosophical responses.

*Do the devices affect students’ behaviors?* Lucy’s initial response to this question was emphatic, but she diverted somewhat from the question in offering her justification. She clearly insisted that the laptops’ presence did not affect most students’ social skills. Lucy decisively opined that “when it comes to the 1:1 devices, here’s what I feel like—maybe some people disagree with me—but I don’t think that affects our students’ social skills.” While she conceded that “perhaps a phone, a personal device hinders a little bit of the social skills” for some students who lack self-regulation skills in that regard, Lucy perceived these instances as “a personal thing.” She described how the implementation allows students to “work together using the Internet, so I don’t see a diminishing in social skills at all.” She did not outline other behaviors or justifications for this rationale. She

expanded on her perspective by circuitously detailing the 1:1 implementation's pedagogical benefits as advantageous and expedient.

*Does students' laptop use impact personal device use?* Lucy's response was nuanced, and—as some of her previous responses—both sensitive and sympathetic to students' lived experiences. She first distinguished students' phones from their school-issued laptops by characterizing the latter devices as those “designed to do the academic part of it.” Toward the end of her response, though, she decided that “there's a big difference between the phone and the Chromebook device, because, like I said, [the phone] offers that social aspect to it.” Within her response, she acknowledged both devices' usefulness and capacity for distraction, but Lucy seemed to accept students' difficulties or struggles to elicit the former from the latter and ultimately accept such trials as inevitable. Still, this inevitability neither laid blame nor asserted deficiency in Lucy's students.

Though she distinguished the academic from the personal, she also tacitly acknowledged the laptops' innate capacity to lure students from topical classroom content. Just as in her response to the previous question, Lucy expected and sympathized with students who cannot effectively self-regulate their device use. She figuratively compared such instances—when, for example, students' in-class focus wanders “out of the academic” and “into the social aspect” of the internet on their laptops—“like putting candy in front of a kid and saying ‘don't eat it!’ you know?” Here and throughout Lucy's response, she insisted that it is adults (specifically, teachers) who must change their behaviors to accommodate their students. When Lucy deployed the “candy” simile, she implied that it is not students' irresponsibility that leads to adverse device-related

behaviors in class, it is adults' irresponsibly tempting students toward distraction. This was echoed in her final sentiments. She pointed out an (at least) ironic or (at most) hypocritical adult demand of students in the 1:1 classroom environment:

I don't know anyone—adults included, so it's funny when *we* get on the *kids* about it—but I don't know anyone that has their phone on them, and one of the things they do *isn't* going on a social media site, you know? Unless those are blocked by the school, you cannot expect the students *not* to go on them. Simple as that.

Just as in her responses to the previous questions, she sympathized with her students via her intergenerational rendering of students' communication and social skills.

*Open-ended responses: Summary.* Lucy's observations were consistent across all three data streams. Just as in her questionnaire responses and her interview responses, Lucy noticed either minimal or slightly positive changes to students' communication and social skills following the district's 1:1 implementation. She stated students' communication and social interactions "remained the same" when oriented toward other students and toward Lucy as her students' teacher. Lucy observed increased device use among students, a change she attributed to "higher demand of technology in class assignments." She also observed students' ability to focus "either remained the same or improved with the ability to work individually on a Chromebook." These responses—alongside Lucy's responses to the questionnaire and interview questions—provide a more complete embedded analysis unit within this case study. Taken together, they answer the research question.

*Research question: What impacts to students' communication and social skills do high school teachers observe after their school district implements a 1:1 student-to-*

*device program?* Lucy did not observe impacts to students' communication and social skills. She defined these skills as flexible, changing, and demonstrable across both physical and electronic mediums. She also believed school was "one of the main places" where students built these skills. Her responses to the questionnaire, interview questions, and open-ended responses comprised a consistent perspective that regarded students' normative social development and communication skills as perennially evolving. For instance, while some teachers posited that students' personal device use evidenced changes to their communication and social skills, Lucy rendered these scenarios exceptionally. Though she acknowledged "a certain group of kids [...] constantly on their [phones]," she insisted "that's a personal thing" squared against gains elsewhere. To that end, Lucy described how the 1:1 implementation further developed students' communication and social skills. She explained how her students learn new communication skills, in particular: how to use devices to communicate without distractions, how to effectively collaborate with group members when members are in different geographic locations, and how to optimize available technology.

### *Judy*

Judy is a world languages teacher. Judy's questionnaire responses indicated she observed changes to students' communication and social skills since the district's 1:1 implementation. These changes were nuanced, and Judy speculated their causes, effects, and the extent to which the 1:1 implementation affected them. She first distinguished a somewhat innocuous, post-implementation change to these skills (similar to Lucy's initial observation) occurred in her students: when they finished their work, they quietly engaged their devices instead of socializing with nearby classmates (as they did before

the implementation). While Judy noticed students' increased device use in the school's public areas, she could not definitively attribute this observation to the 1:1 implementation since this increase predated the district's initiative. Overall, she observed how the district-issued laptops stifled students' prospective social interactions involving new acquaintances with whom "they wouldn't normally interact [...]. When you can just text your friend in another class, why do you need to branch out and meet the kid you don't know who is sitting next to you?" she wrote. Judy observed how—as students' in-class verbal communication decreased—her students grew both less accustomed and less comfortable with speaking in front of others. She "noticed a significant increase in the amount of anxiety students demonstrated" in this regard, and hypothesized students' decreased familiarity with classmates contributed to such increased anxiety.

During our interview, Judy defined student engagement according to active, valuable indices juxtaposed with a "mindless" alternative. She defined students' communication skills according to the vocational understandings of her academic discipline. She defined students' communication skills according to a similar vocational lens as her definition of students' communication skills. Judy regarded school as a place to build all of these skills, but she perceived changes to students' social behaviors since the 1:1 implementation. Judy was wary of students' increasing preference for device-driven communication as opposed to the "in-person" social relationships and communications that she experienced when she was in school.

*Student engagement.* Judy highlighted three aspects of student engagement: "paying attention," "learning," and "actually thinking about things when you're presented with information in class." These were juxtaposed with an undesirable, hypothetical

alternative: “simply sitting there and mindlessly taking notes.” Judy’s use of the adverb “actually” before “thinking about things” along with her uses of adverbs “simply” and “mindlessly” in the latter quote connote a disdain for pointless work. Such disdain suggests Judy perceives engaged students as distinct from busy ones.

*Communication skills.* Judy defined students’ communication skills along technical, discipline-specific understandings framed “within the world language classes.” She outlined “four components” comprising the term: reading communication, speaking communication, listening communication, and writing communication.” Judy also distinguished “student-to-teacher communication” and “inter-student” communication within her definition. Judy’s recognition of these simultaneous dynamics allowed for her wide interpretive lens. While Judy did not mention any devices in her definition, she perceived communication as innately multifaceted and context sensitive.

*Social skills.* Judy succinctly defined social skills as “the ability to interact with one another appropriately.” She explicated this definition by highlighting what judgments of propriety may entail. Above all, she described students’ context sensitivity as essential. For instance, Judy distinguished how “in a school setting, social skills are being able to relate to classmates, and then also being able to communicate to more than one person at a time, like the presentational mode of communication.” These understandings comprise more than simply verbalizing thoughts, but actively sending and receiving the scholastic situation’s pertinent understandings. Judy differentiated these scholastic communications from students’ social skills with adults. She distinguished these as important, but according to more traditional guidelines, such as “looking someone in the eye” or “being

able to answer a question when one is asked of you.” While distinct, these social skills also entail context sensitivity.

*Should school build these skills?* Judy perceived school as a place to build engagement, communication, and social skills. Judy stated that “everything in life is built around social skills. So I think that—no matter what subject you’re teaching—you’re teaching students how to interact with the material, with each other, with the teacher.” Her response aligned with her rendering of social skills as context sensitive: since school requires students to adapt to the norms and requirements of communication and socialization—with peers and teachers, formally and informally—school is naturally a place to build these skills.

*Do the devices affect students’ behaviors?* Judy perceived the laptops affected students’ social behaviors. She acknowledged this change directly in stating that “yeah, I mean, I think having a device in front of you makes you much more likely to focus on that device.” She contextualized her rendering of these perceived changes by recalling her own high school experiences. Judy specifically pointed to the value of her social experiences as a high school student by virtue of such experiences’ scarcity outside of the school day. Judy recalled that she “ended up talking to people that I would never talk to outside of these classes, just because they were the only source of interaction that I could have.” She contrasted these experiences with those of her students:

Now, when students have a device in front of them, they can zone out, they can—they might be done with their work, which is fine—but then they open up their devices. And maybe they’re doing work for another class—which is great, and a good use of their time, I guess—but they’re not interacting with each other. They’re not interacting with anyone that might be slightly uncomfortable for them to interact with, and so they’re

not being exposed to anyone outside of the people that they're already really comfortable with.

Judy juxtaposed the devices' academic utility with perceived social costs wrought by the devices' relegation of in-person social value. Her response implied a belief in such interactions' necessity: that students are not meaningfully engaging new contacts at school, in an in-person sense, to the extent that they once were.

*Does students' laptop use impact personal device use?* Judy first indicated some confusion by replying, "honestly, I don't know." She acknowledged that such impacts are hard to meaningfully discern from what have become routines of modern life. While she recognized "students sitting with their laptops open in front of them, with their cell phones," she quickly equivocated this perception by admitting that she is "doing it too; I've got mine here with me." Importantly, Judy distinguished students as uniquely, newly, and perhaps problematically "so much more comfortable now interacting with these screens rather than with people. And they're so much more distracted by them, so that they don't even notice what's going on." Since she acknowledged her own tendency to use multiple devices, Judy did not seem to disapprove of the devices' presence. She seemed genuinely concerned, though, both by her students' inability to self-regulate their use and by their continued preference for screen time in a context so traditionally social in an "in-person" sense.

*Open-ended responses: Summary.* Judy primarily noticed students' increasing verbal reticence and diminishing focus. As students used their devices more often, they increasingly preferred electronic communication to verbal communication. At the same time, students increasingly struggled to devote attention to tasks.

Fundamentally, Judy observed her students' device use increased since the 1:1 implementation. This observation aligned with her questionnaire responses that related a similar uptick. On each class period's start, for instance, Judy's students—without her prompting—readied their laptops for the day's lesson. She noted such demonstrable readiness was not, in itself, problematic; it even reflected students' preparedness “akin to [their] taking out their notes/pencil at the beginning of class.” Nonetheless, she was compelled to note the increased screen time.

Judy noticed how the laptops' propensity to disrupt students' attention affected their behaviors. In particular, she indicated her students' ability to focus “decreased significantly” since the district's 1:1 implementation. She contextualized this decline by exemplifying how the devices curtailed some of her students' communication and social skills, particularly the frequency of their speaking. She described how her students “frequently change tabs, notice messages from other people, or even interrupt me/the class to ask about [a new assignment] notification that just came through.” While her students struggled to manage these distractions and more frequently engaged their devices, they verbally contributed less often.

Her open-ended responses indicated how the devices (and their distractions) siloed students' social interactions, relegating “especially verbal communication” to known acquaintances at prospective acquaintances' expenses. Still, even friends seated adjacent to one another often preferred electronic communication to its verbal alternative. Judy posited several reasons for her students' reluctance to verbally communicate: “maybe for privacy? Maybe to include other friends in the conversation? Maybe even to be ‘polite’ and not distract other people?”

Finally, Judy noticed two concurrent, student-to-teacher, post-implementation changes to students' communication and social skills. First, student requests (e.g., "about grades") were increasingly emailed rather than verbalized. In this way, Judy's students' electronic communication preferences were not strictly limited to peer-to-peer contexts. Second, as the rate of these electronic student-to-teacher communications increased, Judy observed how students increasingly perceived "email as an extension of texting." In this way, while Judy's students' electronic communications preferences changed, their situational understanding of these channels' norms has not changed commensurately.

*Research question: What impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program?* Judy observed several impacts to students' communication and social skills since the district's 1:1 implementation. These impacts included more frequent device use, diminished ability to focus on assigned tasks, increased proclivity—in both student-to-student and student-to-teacher scenarios—for electronic communication as opposed to verbal communication, fewer social interactions between students who were not already acquainted, and difficulties discerning appropriate formality and timing of electronic messages.

### *Jane*

Jane is a mathematics teacher who primarily instructs upperclassmen. She directly and concisely answered the questionnaire's three questions. She did not observe changes to students' communication or social skills following the district's 1:1 implementation. If changes occurred, Jane regarded these as positive. Her response to the questionnaire's

second question—regarding students’ device use in the school’s public areas—included a portrayal of students’ device-centered collaboration. While she did not classify this portrayal as a change, she noted the image’s positivity. She recalled seeing “students working together to create videos in the hallway for foreign language classes—so I would say that helped their communication.” Overall, she believed the district-issued laptops “helped students work together and collaborate easily.”

During our interview, Jane’s student engagement, communication skills, and social skills definitions were strongly informed by her emphasis on students’ verbal interactions. She defined student engagement as verbal and participatory. She defined communication skills as primarily verbal in nature and absent any mitigating devices. She defined social skills similarly. Jane described the school as an important place to build social skills, and she illustrated such skill-building by highlighting her students’ verbal interactions with her and with each other. Though she did not discern changes in students’ social behaviors since the 1:1 implementation’s outset, she also acknowledged that as a teacher of upperclassmen—the last to receive the district-issued devices—she did not have as much experience discerning changes as other teachers.

*Student engagement.* Jane defined student engagement as a consciously participatory process in which students are “active” and “not just *there*.” Jane centered her definition of engagement primarily on rich, verbal discourse. She defined student engagement as “just having the kids talk to me,” and she lamented scenarios in which students did not verbally participate. She contrasted these moments to those in which students are “engaged.” She defined the term “engaged” as “to have some kind of a relationship going inside the class. And not just about school, too.” Jane’s use of the term

“relationship” alongside her valuation of students’ experiences outside of formal teaching and learning contexts connoted an authentic interest in her students’ wellbeing.

*Communication skills.* Jane defined communication skills as distinctly, though not exclusively verbal in nature. She also distinguished these communication skills as those transpiring without devices. She detailed students’ communication skills in practice when “they’re actively working on a problem, they’re making eye contact, they’re communicating with each other.” She followed the previous sentiment by adding, “And not through texting. Not through the phone.” Thus, as Jane distinguished the nature of students’ communication skills as “in-person,” she perceived these skills as fundamentally distinct from students’ device-oriented communication skills.

*Social skills.* Jane defined social skills primarily according to verbal indices. This aligned with her definitions of student engagement and communication skills. Notably—and in accordance with this study’s questionnaire’s bifurcating students’ behaviors according to “primary instructional spaces” and “school’s public areas” lines—Jane defined students’ social skills as demonstrable beyond her classroom’s walls. She defined social skills as “how they talk to each other in the hallway, and how they talk to each other in my classroom, when they come into my classroom, how they talk to me, you know?” This rendering of students’ social skills aligned with Jane’s demonstrable concern for students’ wellbeing outside of the classroom.

Outside of students’ willingness to speak—to Jane, or to each other—Jane recognized nonverbal behaviors as decidedly social. She listed “laughing, smiling, not just words, but *any* kind of face-to-face, making eye contact [laughing] in my general

direction” as behaviors comprising students’ social skills as well. This attentiveness to students’ expressions aligned with Jane’s acknowledging innate variability in students’ outward verbosity. She concluded her response by reinforcing “eye-to-eye contact” as important to social skills.

*Should school build these skills?* Jane characterized school as an important place to learn social skills. She also recognized her own importance within this process as one tasked with imparting these skills. She said, “my job is to create little, good human beings. Meaning that they’re going to go out and they’re going to need to be able to talk to other people, and work with other people [...]” In accordance with her reasoning in previous responses, Jane perceived school as a place to learn social skills because of deficiencies in learning opportunities outside of school. She recognized her classroom as a place for students to learn social skills, in part, because “not all of them are athletes, not all of them are in any kind of club. A lot of them are relying on their gaming skills, their social scenes, their ‘Snapchatting.’” While Jane did not disregard these interpersonal contexts’ validity for those students who socialize in these gaming, sporting, and device-driven ways, she detailed her classroom as a place to learn social skills.

*Do the devices affect students’ behaviors?* Jane did not perceive the devices’ presence had any effects on students’ social behaviors. Jane primarily regarded the computer as an instructional resource rather than a disruptive force. Despite the question’s focus, she described several of the laptops’ academic uses to this end. She observed the students’ laptops “did not take away from the interaction that was going on between us, like the banter, the talking, the explaining, So I would say no [the devices did

not impact students' behaviors]." Here, Jane once again valued students' contributions in her classroom—from which the devices might hypothetically detract—as primarily verbal in nature.

*Does students' laptop use impact personal device use?* Since Jane primarily teaches upperclassmen—who were last to receive the district-issued laptops during the 1:1 implementation's phase-in—she felt that she was not the best to respond to this question at length. However, she does not “think that they use their phones for school, really, I think they use their phones for social purposes, in my opinion.” In this comment, she clearly distinguished students' scholastic regard for their devices from their social regard for personal devices and did not distinguish an overlap between the two.

*Open-ended responses: Summary.* Jane's open-ended responses were brief, direct, and concise. Overall, she noticed few if any changes to students' communication and social skills. While her students' device use increased, this “increase in technology” since the district's 1:1 implementation “has not changed” her students' ability to focus. Jane noted her students' communication and social interactions with other students also remained unchanged. With the exception of “time spent reminding [her students] to put their phones away,” Jane's students' communication and social interactions toward her, their teacher, remained unchanged as well.

*Research question: What impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program?* Jane did not observe impacts to students' communication and social skills following the district's 1:1 implementation. Though she did not observe these

impacts, she was sensitive to these skills' overall importance. She regarded school as a "huge place for [students] to learn social skills," and she regarded students' development of these skills as part of her job "to create little, good human beings. Meaning that they're going to go out and they're going to need to be able to talk to other people, and work with other people [...]." With this description in mind, her students' ability to focus since the 1:1 implementation "has not changed with the increase in technology."

Though Jane clearly indicated the district's 1:1 implementation did not impact her students, some of her responses hinted at emergent changes to students' communication and social skills. She indirectly implied some students' communication and social preferences changed. When she defined students' social skills as "laughing, smiling, not just words, but any kind of face-to-face, making eye contact [*laughing*] in my general direction," her description implied, at least, how difficult cultivating these qualities could be. Further, she acknowledged how "in terms of each other, there's a lot of texting that goes on, and in terms of *inside* the classroom, I think—if given the opportunity—that they're probably more comfortable that way." Ultimately, while this explanation implied students' increased electronic communication, Jane did not situate such increases as problematic or, crucially, impactful.

### *Andy*

Andy is an English teacher; he teaches theatre classes, as well. Andy's questionnaire responses indicated he observed changes to students' communication and social skills following the district's 1:1 implementation. Andy primarily observed how—following the district-issued laptops' distribution—students increasingly devoted their attention to these devices. He also described how this shift came at physical, student-to-

student interactions' expenses. Andy explained how this shift transpired in his classes: as his "students spent less time interacting with classmates," they seemingly became "less likely to answer questions in a group setting, either absorbed in their computer or preferring to write responses." Andy lamented how students' increasing preference for electronic communication alongside "technology not just readily available but encouraged and required" combined to "give students an out" in formerly person-to-person communicative classroom contexts. Andy also observed changes to students' communication and social skills outside his classroom. In both the hallways and the cafeteria, students often used their laptops silently, even when flanked by friends. Overall, Andy noted how these changes transpired without clear institutional guidance as to how, when, for what duration, or under what circumstances teachers should or should not regulate students' device use.

During our interview, Andy defined student engagement as participatory, demonstrable, and pointed in a finite educational direction. He defined students' communication skills abstractly, but he delineated a "face-to-face" component from a second and harder-to-define component. Andy defined students' social skills as comprising a deployable, interpersonal skillset. He regarded school as an important place to build all aforementioned skills. Ultimately, Andy believed the district-issued devices impacted students' behaviors, and students' personal device use, in turn, impacted students' use of the district-issued laptops.

*Student engagement.* Andy defined student engagement as attention directed toward "a given circumstance or activity within a classroom." He recognized students' demonstrable, focused participation as a hallmark of high-quality student engagement. By

contrast, Andy characterized “bad student engagement” as situations in which students are “in and out, checking in and out.” Overall, Andy’s definition of student engagement comprised students decidedly oriented toward the desired focal point to the extent that students meaningfully and consistently interact with it.

*Communication skills.* Andy’s definition of students’ communication skills immediately separated a “face-to-face” component, a more “obviously” familiar distinction, from an esoteric and secondary form that he ultimately left nameless. His response reflected an active sensemaking process: of the definition-eliciting interview questions, he was most unsure of this question’s response. He stopped his response at one point to ask a rhetorical question, “what is our social contract that we have with communication and the power of communication?” before concluding his definition by defining communication as inclusive of “writing.” When Andy asked about “our social contract” with communication, he implied that his definition—or “our” definition—of communication skills is evolving under complex, not easily understandable conditions.

*Social skills.* Andy succinctly defined social skills as “the ability to use those communication skills in regards to other people, and what relationships those communication skills foster.” He did not elaborate on this. His response connotes an understanding of social skills as interpersonal skill deployment oriented to a human other.

*Should school build these skills?* Andy considered school an important place to build students’ aforementioned skills “to a high extent.” He regarded this skill-building process to be fundamental, underpinning educators’ approach to teaching, to the extent that “most of [teachers’] lessons in one way, shape, or form should be building on one of

those skills.” Andy’s rendering of the school as a place to build students’ engagement, communication skills, and social skills was philosophical in nature. As a matter of principle and irrespective of content, level, or department, teachers’ instruction comprised this skill-building process.

*Do the devices affect students’ behaviors?* Andy believed the 1:1 implementation’s laptops “definitely” affected students’ behavior. His response elicited two interrelated phenomena: first, the devices’ expediency was detrimental; second, the devices adversely affected students’ contextual awareness when they shifted their attention from the physical classroom to their computer screens. To the first of these, Andy suggested the computers’ instant communication capacities tacitly fostered students’ superficiality in communicative contexts. In this way, students’ output was adversely affected. Nonetheless, he was not accusatory: he regarded himself—alongside his students—equally culpable in succumbing to this dynamic. His response highlighted—from a distinctly egalitarian perspective—his and his students’ difficulties navigating digitally immersive classrooms:

It’s so easy to type something, send it off, type it, send it off rather than draft through things so when you talk about communication skills—specifically with writing, I think that it puts us into a bad habit, right? Even just having the devices in front of us.

Andy notably deployed the first-person, plural pronoun “us” in this excerpt. Contextually, this pronoun use implied Andy actively considered his own relationship to device-laden adult life outside his classroom. Here, he too acknowledged having fallen into the “bad habit” of superficial composition amidst devices’ mere presence.

The second phenomena Andy identified was his students' diminished contextual awareness when shifting their attention between the laptops and the physical classroom.

In this domain, the laptops' presence adversely affected their social interactions:

If we're looking at social skills in terms of creating relationships—within the classroom, as a full class—I also think that it really takes the students out of the 'full classroom experience' and bring it really into the front of them as 'an individual experience set in a larger classroom' rather than 'a larger classroom setting.' And I think, again, just even having [the laptops] present does that.

While Andy primarily described his students' difficulties navigating 1:1 education's new and complex social dynamics, he also delineated and simplified these dynamics into three settings. First, in context, Andy's "full classroom experience" implied "a traditional, device-free classroom setting," while second, his "individual experience set in a larger classroom" connoted "students' operational, realistic 1:1 educational setting."

Considering Andy emphasized the school's—and particularly, teachers'—importance in developing students' engagement, communication skills, and social skills, this latter description is at odds with (third,) "a larger classroom setting." This setting, then, indicated "a setting in which interpersonal skills are fostered." Juxtaposed with one another, these domains were difficult for both Andy and his students to reconcile. "It's hard to hold them," he said. "It's hard to pull them out of that 'individual setting' into a 'larger class setting.'" If Andy's use of the word "setting" implied, at minimum, "a time and place," he was speaking to his "difficulties educating students—perhaps in spite of the classroom's appearance—in varied places at varied times." This displacement permeated most of his response to this interview question.

*Does students' laptop use impact personal device use?* Andy believed his students' laptop use impacted their personal device use. He detailed how students blend academic and nonacademic device use and how adults may not be accurately evaluating students' abilities to differentiate these domains. Both of these descriptions aligned with Andy's answer to the previous question; they aligned with his suggestions that students are navigating multiple contexts and settings within his 1:1 classroom. He described his students' (and, perhaps, his instructional) difficulties matching appropriate device use to a given context. He indirectly (and, perhaps, pedagogically) ascribed these difficulties to a model's absence. He explained that "there doesn't seem to be a basis [...] for how we differentiate: 'okay, this is my *work* computer; these are my *work* devices,' and then 'these are my *social* devices; these are my *communication with my friends* devices.'" Without best practices, curricula, or research-based advisement in this regard, Andy was unsure how, when, or to what extent students should or should not merge academic device use with nonacademic device use. His response suggested a separation of some kind was ideal, but tellingly, he closed by opining that his students "just haven't seemed to find that delineation between the two of them that, I think, a lot of adults just sort of assume kids know."

*Open-ended responses: Summary.* Andy's open-ended responses were brief, concise, and direct. He articulated changes to students' communication and social skills since the district's 1:1 implementation. He noted how his students' device use "increased both for school as well as personal purposes" while their ability to focus became less predictable. His students' focus "became more varied and more dependent on the task at hand," thus his ability to hold "their attention on independent tasks became harder." To

that end, Andy described both student-to-student and student-to-teacher communication and social interaction as “more stunted.”

*Research question: What impacts to students’ communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program?* Following the district’s 1:1 implementation, Andy observed several impacts to students’ communication and social skills. He described how students struggled to discern certain communication channels’ norms. Andy explained how students did not clearly separate their social communications from their academic work on the district-issued device uses, suggesting “there does seem to be sort of like a merging of the two.” Similarly, Andy noted how students used informal syntax—characteristic of “slang they would be using with their cell phones”—when they sent him messages. In addition, Andy noted how the laptops’ compositional expediency led to less thoughtful drafting.

Andy also indicated how the devices’ presence impacted students’ communication and social skills as these pertain to a collective classroom experience. He detailed how “if we’re looking at social skills, you know, in the terms of creating relationships,” the laptops’ presence diminished students’ “full classroom experience” in favor of “an individual experience set in a larger classroom.” Students struggled to skillfully direct and redirect their focus between electronic stimuli and students’ physical classroom environment. When they struggled this way, Andy described how hard it was to maintain a traditionally cohesive classroom dynamic, “if we’re constantly going back-and-forth to ‘look at your computer, now come back, look at your computer, come back.’” Finally, students became less willing to verbally contribute in front of classmates.

## *Lawrence*

Lawrence teaches technology classes to students enrolled at The Academy for Mathematics, Science, and Engineering, a STEM-focused vocational school located at SCRHS to which students in Morris County may apply for admission. Lawrence and others commonly call it “The Academy.” While Lawrence teaches Academy students, and The Academy is a partnership between the SCRSD and the county’s vocational district, Lawrence is a SCRHS faculty member. Lawrence’s questionnaire responses were both concise and direct. Across all three questions, he did not observe changes to students’ communication and social skills following the district’s 1:1 implementation. His responses regarded the students’ laptops from a utilitarian perspective. To Lawrence and presumably to his students, the new devices were simply additional resources to what was already a technologically immersive classroom environment. In this way, the devices’ addition did not represent meaningful or disruptive changes to the classes’ dynamic. Since his classroom already had desktop computers, he noted how students commonly used their district-issued laptops as second monitors to improve “their work flow, productivity, and output.”

During our interview, Lawrence defined student engagement by depicting students visibly and, often, independently committed to pressing tasks. His definition of communication skills was flexible and context-sensitive, but it consistently positioned students’ ability to communicate as related to their self-advocacy. Though he did not explicitly delineate students’ social skills from their communication skills or engagement, he regarded school as a place to build these skills. His teaching philosophy especially prized this self-advocacy, as evidenced by his depictions of students’ engagement,

communication skills, and social skills in action. Lawrence firmly believed the 1:1 implementation did not change his students' behaviors, but his portrayal of his students' personal and academic device use was conditional and complex.

*Student engagement.* Lawrence defined student engagement as task-oriented and measurable according to students' buy-in level. He described these scenarios as those “when they're working—either independently or collaboratively—and you can kind of sit back, as a teacher, and you *know* they're *all in*. 100 percent.” In his definition, Lawrence implied ideal student engagement was self-sustaining, that it did not require the teacher's intervention. Instead, Lawrence positioned his teaching role simply as another resource within a resource-rich classroom context. Since Lawrence's subject area was often project-based, and since his students were high-performing, his fullest manifestation of engagement was students' actively learning from one another. His definition of student engagement valued his students' capacities to skillfully and ultimately manage their own learning to the extent that “they're not even realizing it, and they come away with some pretty cool stuff: the knowledge on the back end. [...] It's just being able to [...] see it almost manage itself.” Lawrence's definition valued students' autonomy: he prized their resourcefulness, he created a “collaborative, open atmosphere” that fostered student engagement. He wanted his students to interpret instructions, develop time- and task-management skills, and personalize projects according to their preferences.

*Communication skills.* Lawrence defined students' communication skills as borne of students' self-advocacy, contextually flexible, individually and interpersonally applicable, and occupationally focused. From his students' first days, Lawrence

emphasized students' abilities to advocate for themselves. He couched this self-advocacy mandate within communication skills using several diverse, problem-based scenarios. If, for instance, in a group project, a student did not feel that a classmate shouldered a fair workshare, Lawrence wanted his students to take action, "to call them on it, you need to advocate for yourself and communicate what you are trying to say." He also highlighted how engineering's nearly infinite capacity for application demands occupational communication skills that transcend languages, time zones, and cultures.

We talked about [communication skills] a lot, especially in terms of engineering. We talked about it off the bat: it's essentially another language, and it's a universal language in that [for example,] if you do an engineering drawing and there are dimensions on there, and you have to give that [drawing] to somebody across the world and there's a language barrier—and you can't speak [this other person's language, be it] Japanese, or [Mandarin], or [Hindi]—you need to be able to clearly, and concisely, and accurately showcase your ideas through your drawings. You need to be able to—through *that* language [of engineering]—be able to tell them that, and it needs to be clear.

Thus, students' communication skills needed to reflect universal clarity via strategies best suited to a project's immediate circumstances. Lawrence implied the discovery of such clarity is central to building communication skills in his classes.

Much of Lawrence's definition of students' communication skills concerned students' capacities to accurately and independently self-assess a situation's communication-related expectations and its outcomes. His examples were distinctly problem-based and they reflected Lawrence's elastic, occupational, and sophisticated definition of communication skills: in the first example, a student needed to voice concerns regarding a fellow group member's output. In the second, an engineering problem necessitated understanding between two mutually unintelligible parties (in a conventional sense). In both, to deploy successful communication skills was to solve each

hypothetical problem. Unsaid, but perhaps understood in these examples, were the delicate communicative circumstances framing each problem. In the first, students were not simply expected to vocalize displeasure with a fellow group member, they were expected to do this while ultimately eliciting the fellow group member's optimal output for the task. To that end, students were assumedly expected to voice concerns diplomatically to the extent that the group member's feelings remained unhurt. In the second problem, Lawrence wanted his students' work to reflect such clarity that linguistic translation was superfluous. To accomplish this required deep, discipline-specific understandings that communicate engineering realities.

In each of these examples and circumstances, even when he focused on students' behaviors in his classroom, Lawrence's definitions of students' communication skills were focused on students' prospective professional lives after secondary or postsecondary schooling. They reflected likely occupational circumstances outside of Lawrence's classroom. For example, when Lawrence exemplified a poor alignment of students' communication skills, he (notably) used email as a demonstrative medium. He explained that since his students will need to network in professional circumstances after high school, the students must accurately hone communication skills that build networking prowess. With this in mind, Lawrence instructed his students to demonstrate communicational awareness of their hierarchical position (as students) when emailing him (as their teacher) via students' syntactical choices. "I get on them even if they write me an email and the spelling is bad, the grammar is bad, and it's very 'short-hand' text," he said. To ameliorate these scenarios, he implored his students "to train

[yourselves] to get away from that.” Again, with occupational goals in mind, Lawrence reiterated a universal truth about communication skills permeating his academic discipline: that whether or not his students ultimately wished to work for themselves or for others, their work has “got to sound professional. It’s got to come across.”

*Social skills.* Though Lawrence commented extensively on how students socialize in his classroom, he did not directly answer this question. His responses were lengthy and informative, but these responses’ digressions made constructive meaning extrapolation difficult.

*Should school build these skills?* Lawrence did not directly answer this question. However, Lawrence’s answers to both the previous and following interview questions reflect his emphases on student engagement, communication skills, and social skills. He depicted how students build these skills constructively in his class, even if he did not directly opine in response to this question.

*Do the devices affect students’ behaviors?* Lawrence did not believe the district-issued laptops affected students’ behavior. Since his students already used his classroom’s desktop computers, the laptops’ presence did not meaningfully alter his class’s extant dynamic. He explained how initial productivity expectations in his class’s technologically immersive environment led to students effectively self-managing their class time. “They get to the point where they walk in, and I don’t have to say a word,” he said. “They go right to the computer, bring up the program at get started.” Lawrence regarded this approach as students’ interpersonal self-advocacy: “they know where to go,

they know that they are allowed to walk around and help one another. That's part of the process." As in his definition of communication skills, Lawrence valued students' decision-making autonomy as both a consequence and a goal. It is a consequence in its pragmatism; Lawrence recounted how he advised students to seek help from classmates if he was busy working with another student: "you are probably going to learn more from your peers than from me, especially if there are 26 of you, you know?" It was a goal in that his student engagement definition comprised this autonomy. Whether goal or consequence, developing students' autonomy—and its decision-making, judgment, and communication skills building blocks—underpinned Lawrence's teaching philosophy long before the 1:1 implementation. As a result, the devices' introduction did not change his students' behaviors.

*Does students' laptop use impact personal device use?* Lawrence did not clearly distinguish whether or not students' laptop use impacted their personal device use. His response was complex. The district's 1:1 implementation did not affect how he regarded his students' device use, but the implementation did provide more devices for students to use. While at times, he clearly recounted how students' device use impacted their use of another device (e.g., he allowed his students to use personal devices or district-issued laptops as additional monitors to his classroom's permanently installed desktop computers), he framed such uses as student-driven, utilitarian, and pragmatic: analogous to his students choosing more or better tools rather than a departure from previous behaviors. Thus, it was difficult to conclude Lawrence believed such uses as "impactful" since students' previous behaviors were not, as his previous response indicated, changed by the 1:1 implementation.

For me, it's just a clear expectation for the 90 minutes that we're in the room. Create that safe space and create the expectation, [then students] utilize whatever [they] can, learn wherever [they] can get it: I am not the end-all-be-all; I'm not the center of the universe. Here, we are all in this together. So utilize technology the way you can, but utilize it in a good way. In my class, I'm open to anything, [...] whatever technology they can use.

Here, Lawrence regarded his students' device use according to the same philosophy he ascribed to students' communication skills and general behavior in his classroom: with emphases on resourcefulness, productivity, and especially students' autonomy.

*Open-ended responses: Summary.* Lawrence's open-ended responses eschewed the question's pre-COVID-19 focus and, as such, could not be used alongside the other respondents' data. His responses were post-pandemic reflections. As a result, these could not be included in this study.

*Research question: What impacts to students' communication and social skills do high school teachers observe after their school district implements a 1:1 student-to-device program?* Lawrence did not observe impacts to students' communication and social skills following the district's 1:1 implementation. Since his classes have long necessitated computers, the district-issued laptops were not impactful. Regarding engagement, communication skills, and social skills, Lawrence valued students' autonomy to foster and to deploy these according to students' personally preferential, or at least self-regulated, contexts. He has—as a matter of teaching philosophy—always encouraged students to self-advocate, assist one another, and exercise resourcefulness in classrooms with computers and other pieces of technology. Therefore, prospective changes to Lawrence's students were not present.

### *Participants' Results: Emergent Themes*

This section presents three themes that emerged from analyses of this study's participants' questionnaire responses, their interviews, and their open-ended responses. These three themes are in addition to the two themes that emerged from analyses of the 24 questionnaire respondents' answers. The first of these themes explains how deep analyses of the superficial similarities between participants' student engagement definitions uncovered complexities: similarities, differences, and insights into the participants' lived experiences following the district's 1:1 implementation. The second theme links these participants' student engagement definitions to their answers to this study's research question. The third theme explains the 1:1 implementation's disparate effects on classes' collective cohesion.

#### *Superficial Similarities Between Participants' Student Engagement Definitions Belied Substantive Differences Between Participants' Perspectives.*

Though participants' student engagement definitions somewhat aligned, important differences between these definitions emerged. Participants broadly described similar phenomena as that which constituted students engaged: students working on pertinent material (e.g., assignments, projects, activities), students directing their focus toward different stimuli (e.g., the teacher, other students, devices), and students demonstrably actuating teacher-to-student knowledge transference. Still, the nature of these phenomena differed considerably. These differences emerged when I coded the participants' diction, and they continued throughout the data analysis process.

When I coded participants' responses for emergent themes, I first examined similarities and differences in participants' diction. While, again and broadly speaking, all participants described students *doing something*, there were only negligible (if any)

similarities in the words participants used in their definitions. Participants defined student engagement using the terms “attention,” “active,” “participating,” and “work.” These terms were deployed somewhat similarly, and it was easy to link contextual similarities. It was not unreasonable to surmise all participants would, in a hypothetically subsequent group interview, agree to the following synthesis of their student engagement definitions: “active” students “participating” during classes, paying “attention” to complete “work.” Perhaps paradoxically, these terms were not coextensive. Further analyses yielded complexities in their nature, scope, and context.

All participants used at least one of these terms one time in their student engagement definitions (shown below in Figure 4.5). Still, no participant used any more than two of these terms, and no term was used by any more than two total participants.

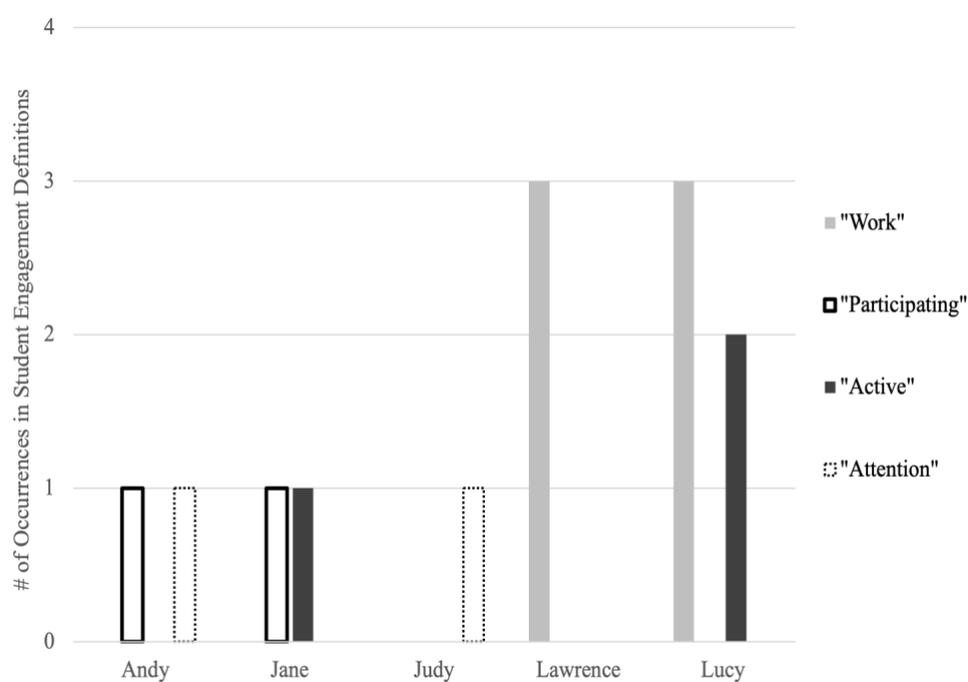


Figure 4.5. Participants’ diction in student engagement definitions.

These similarities and differences in participants' diction carried complex thematic implications. Andy's and Judy's shared use of "attention" foreshadowed strong thematic connections between their questionnaire, interview, open-ended question, and research question responses. Similarly, Lawrence's and Lucy's shared use of "work" foreshadowed strong thematic connections in these same capacities. Judy's shared use of "participating" with Andy alongside her shared use of "Active" with Lucy did not foreshadow her research question response. However, these shared uses did foreshadow her tendency to eschew easy categorization. Interestingly, these responses also foreshadowed differences between this study's only two teachers who shared an academic discipline—Lucy and Judy, who both taught foreign (albeit different) languages—as their responses here and throughout the study shared little in diction, content, and perspective.

After I coded participants' diction, I uncovered further links between their student engagement definitions that extended long past word choice. Deep analyses of participants' responses revealed several complex commonalities and critical differences between participants' perspectives. I found that Jane, Andy, and Judy defined student engagement by depicting poor student engagement within their definitions. I also found distinct commonalities between Jane's and Judy's diction, syntax, and messaging.

Andy defined student engagement as "the attention that students given to a given circumstance or activity within a classroom," and he recognized "bad student engagement" when his students were "in and out, checking in out." This characterization of poor engagement—in which students' focus is diverted from an intended source—consistently represented Andy's perspective throughout the three stages of data

collection: he valued students' intentionality and expression within a vibrant, collectivist rendering of a classroom's culture.

Jane and Judy also depicted poor student engagement in their definitions, and their syntax, diction, and messaging closely aligned. Each participant's response juxtaposed directly dependent portraits of positive and negative student engagement. Jane described her students as engaged when they were "active, and participating, and not just *there*." To Judy, student engagement consisted of her students "paying attention and learning, actually thinking about things when [they're] presented with information in class, rather than simply sitting there and mindlessly taking notes." While Andy's definition of poor engagement left some room for students' cursory actions, Jane's and Judy's respective uses of "*there*" and "sitting there" connoted and denoted a poor student engagement portrait as entirely passive. This passivity was so total that each respondent implicated the intrinsic value of the education taking place in such moments was questionable.

Judy denoted students' total passivity when she used the adverb "mindlessly" before "taking notes," and when she positioned these as opposed to "paying attention and learning, actually thinking about things when you're presented with information in class." While "paying attention," "learning," and "thinking about things" are flexible ideas open to interpretation, all of these are—to some degree—coextensive with actively processing information. These stand in stark contrast to the "mindlessly taking notes." Notetaking, especially within 1:1 contexts, is the sort of rote task allegedly ameliorated by issuing computers to students.

Jane lamented this passivity when she recounted “a lot of times where students don’t talk to me and don’t try to give answers, and so them being engaged would be to have some kind of a relationship going inside the class.” In a denotative sense, Jane positioned relationship-building as indicative of engagement; she regarded students’ demonstrable expressions of “active” interest when they were “participating” as said relationship-building: active engagement as opposed to inactive passivity. Connotatively, Jane valued student engagement as criteria by which she measured whether or not her students derived authentic meaning from their experiences. If students’ response rates were relationship-building evidence, then their absence—when her students “do not try,” when they were just “*there*”—signified students’ failure to authentically build relationships. Jane’s connotative implication hinges on the word “try” in “don’t talk to me and don’t try to give answers;” it hinges on the word “actually” in her ending assertion that “having students actually talk to me would be an engaging classroom setting.” The connotative hinge is that students’ demonstrable activity in her definition of positive student engagement and passivity in her definition of poor student engagement is—on some level—according to students’ conscious choices.

In this way and importantly, prospective changes wrought by technological additions to her classes were likely perceived through a lens that, ultimately, regarded students’ communication choices and social behaviors as purposeful. After all, Jane implied students were cognizant of their engagement level. However, Judy’s student engagement definition—in particular, its inclusion of the term “mindlessly” as undesirable—implied students, at least some of the time, were not cognizant of their engagement level. Andy’s student engagement definition implied a halfway point:

students who were “in and out, checking in and out” could have been trying their best just as they could have purposely directed their attention toward digital stimuli. That his definition left room for either distinction, though, is notable.

Lucy’s and Lawrence’s student engagement definitions aligned in three ways. First, both teachers distinguished students’ autonomy as a student engagement component. Second, both teachers distinguished such engagement as flexibly individual or interpersonal in nature. Third, both teachers recognized how student engagement manifested in two stages, albeit with notable differences regarding extent. Lucy separated teacher-to-student knowledge or skill transference from students’ individual or student-to-student engagement in a two-step process. Lawrence depicted such engagement in a similar two-step process, but he went further by rendering ideal student engagement as students consciously self-directed.

In her interview, Lucy considered her students engaged when they were “actively doing work that benefits them,” and “using the tools or the skills that I’ve given them previously [...] to be building something in one way or another.” In Lucy’s first quote, student engagement was metacognitive; the “that benefits them” addendum implied students’ demonstrable focus did not, alone, constitute student engagement. To be truly engaged, her students needed to understand how their work yielded personally desirable outcomes. In this way, Lucy valued students’ ability to sincerely, pragmatically, and individually make these decisions. Thus, Lucy’s notion of student engagement comprised students’ ownership of their decision-making process: which material, activities, or circumstances to which they chose to dedicate their focus.

The second quote confirmed this valuation of students' autonomy; Lucy regarded the "building something" process as distinct from teacher-to-student skill transference. Accordingly, she indirectly acknowledged her students did not necessarily need her involvement to demonstrate engagement. This is not to say that she did not regard her role in engaging students—or fostering student engagement itself—as essential. In the previous quote, and when she noted that student engagement "may look like a teacher giving them an assignment and they complete it individually, or working together," she was a critical piece of the educational process. Rather, she considered student engagement demonstrable without her ongoing involvement, irrespective of whether students completed work "individually, or working together." To this latter point, Lucy broadly regarded "what" students were doing as more important than "how" they did it.

Lawrence was similarly open-minded as to whether engaged students worked "independently or collaboratively." He demonstrated this open-mindedness when he praised students' proactive self-advocacy, as when a student who needs help with a project "gets up and goes and talks to another one across the room and is like 'I don't know how to do this,' because, you know, I'm at my desk or maybe I'm helping someone else." This conception of student engagement was variably personal or interpersonal in its manifestation. Much as Lucy regarded engaged students as those autonomously "building something" of self-determined worth following a teacher-facilitated knowledge or skills transference stage, Lawrence defined engaged students as those who know how and why to help themselves. He valued students' metacognition within engagement to such an extent that he depicted their optimal engagement as those moments when he can "kind of take a step back and [see] it almost manage itself: getting it to that point, and they're all

in.” Here too, Lucy’s and Lawrence’s perspectives aligned. While self-advocacy and self-directed learning were evident in both Lucy’s and Lawrence’s student engagement definitions, Lawrence’s conception of student engagement extended Lucy’s insistence that students complete “work that benefits them:” by trusting students to self-discover how, under what circumstances, and to what extent collaboration with others impacts such “work that benefits them.”

#### *Links Between Student Engagement Definitions and Observed Impacts*

While Andy’s, Judy’s and Jane’s student engagement definitions resembled each other in some respects, and while Judy’s and Jane’s bore particularly striking similarities to one another, Andy and Judy observed impacts to students’ communication and social skills, while Jane did not. In addition, neither Lucy nor Lawrence observed impacts to students’ communication and social skills.

These participants’ similar student engagement definitions acquire new significance positioned alongside the fact that neither participant observed changes to students’ communication and social skills following the district’s 1:1 implementation. When both Lucy and Lawrence answered questions about the extent to which district-issued devices’ affected students’ communication and social skills, or the extent to which students’ personal devices use affected their laptop use, similarities emerged.

Since the 1:1 implementation, both Lucy and Lawrence considered most students able to effectively self-moderate their productivity. Despite this shared general perspective, each teacher detailed their personal approaches of problematic device use in their classes. Lucy seemed to regard students’ device use, itself, as a learning process. She was sympathetic toward students’ difficulties balancing the devices’ academic and

nonacademic capabilities. She noted adults' problematic device use, and intimated that teachers should know how tempting devices' presence are to their students. Lucy acknowledged that "yes, there's a group of kids and—a lot of times—instead of looking up and, say, seeing each other, they're constantly on their phone, sometimes even messaging each other." Despite this recognition, she also described such personal device use as "a personal thing." Even in these circumstances, Lucy was empathetic toward students' temptation to improperly use their devices. She could not "necessarily blame a student for clicking out of 'the academic' and going into 'the social' aspect for it because it's like putting candy in front a kid and saying, 'don't eat it!' You know?"

Lawrence similarly stressed the teacher's role in students' device use. However, his rendering of this role positioned the teacher in a more proactive, defined capacity than Lucy's more philosophical, empathetic approach to students' device use decisions. Lawrence emphasized and depicted a cohesive, device use culture predicated on students' collective productivity goals. While—like Lucy—he acknowledged problematic device use, he described it in relation to the environment he created: an open, productive classroom culture that, ultimately, he (as the teacher) had to cultivate. Early in the year, Lawrence established "a clear expectation for the 90 minutes that we're in the room: create that safe space and create the expectation. Utilize whatever you can, learn wherever you can get it." While he valued and, ultimately, trusted students' ability to independently discover how to "utilize technology the way you can, but utilize it in a good way," he dealt with students' problematic device use quickly and directly. He explained how he tried to "kind of get on them right away, [...] and they go, 'oh, they just crossed the line, [Lawrence] is usually pretty laid back.' And I don't ever yell, but I

get serious.” Then, once Lawrence has set a standard for students’ device use, his students generally adhere to his expectations for them. Over time, such expectations became “almost an unwritten rule, I don’t really ever have to tell the kids, for the most part, if they break out the Chromebook, to not be watching videos. They’re not on Discord. They’re not in a chat.” Here, Lawrence’s engagement definition aligned with his answer to the research question: he did not observe impacts to students’ communication and social skills since he already understood student engagement so flexibly. He linked the importance of his class’s atmosphere (e.g., a “safe space,” “an expectation”) to his students’ ability to divergently engage his class’s content on their own terms: individually, collaboratively, with personal devices, or with district-issued devices, or via some combination of all of these.

Importantly, neither Lawrence nor Lucy regarded their classes’ pre-1:1 implementation, collective dynamic as socially or communicatively canonized, static, or forlorn. Though Lawrence, as the teacher, created and maintained his classes’ atmospheres, he—and Lucy—described students as engaged *after* the teacher transferred knowledge and skills to students. At *that* point, students’ communication and social skills are cultivated much as they were before the students were issued devices. To that end: even if, hypothetically, the district’s 1:1 implementation definitely impacted students’ communication and social skills, such changes would be difficult or impossible to discern if, philosophically, teachers regarded such changes as Lucy and Lawrence did: those to be noticed, mitigated, addressed, cultivated, developed, encouraged, and discouraged as teachers regarded such skills before students received laptops.

### *The 1:1 Implementation's Disparate Effects on Classes' Collective Cohesion*

Judy and Andy noted how their classes' collective dynamics were negatively impacted by the district-issued devices, as students increasingly preferred individual experiences within these collectives. They pointed to diminished interpersonal interactions: diminished student-to-student and diminished student-to-teacher verbal interaction.

Judy described how the district-issued devices negatively impacted her classes' collective cohesion by detailing how these devices limit students' interactions. Judy believed "everything in life is built around social skills," and she portrayed high school classrooms as historically collective entities in which social connections develop from necessity. One might have borrowed a pen from a nearby student, struck up an impromptu conversation with a nearby classmate, or partnered with a classmate to complete a task. After the laptops' introduction, students preferred to interact with their devices as opposed to their classmates.

As it became steadily less necessary to socialize, students increasingly preferred not to do so, unless required. Judy illustrated this decline's effect on the class as a collective by explaining how, when she was a high school student, opportunities to socialize were comparatively limited. As a result, she "ended up talking to people that I would never talk to outside of these classes, just because they were the only source of interaction that I could have." This was in stark contrast to her post-1:1 implementation rendering of her class's social dynamics.

Once her students did not have to interact with one another, Judy explained how their social interactions decreased in frequency and in preference, "most noticeably

between students who were not already friends (especially verbal communication). However, even between friends, they often sit next to each other and text.” These siloed, student-to-student communications and social interactions were already markedly different from even the recent past. Though the implications of rigidly limiting social interactions were hard to determine, Judy hinted that when students found comfort in familiarity, they retreated from social interactions perceived as discomfiting, since “they’re not interacting with anyone that might be slightly uncomfortable to interact with, and so they’re not being exposed to anyone outside of the people that they’re already really comfortable with.” Judy’s historical idea of the classroom as a collective seemed fundamentally changed. After the 1:1 implementation, the classroom ceased to be a cohesive collective in which students freely and consciously socialized with each other. It became a quieter, more predictable, less demonstrably social, more electronic space outfitted for individually curated experiences.

Andy also detailed adverse impacts to his classes’ collective cohesion following the district’s 1:1 implementation. His responses were somewhat similar to Judy’s responses in their tone and nature, but critical differences also emerged. While Judy’s portrayal of adverse impacts to her collective classes’ cohesion outlined how students’ diminished skills created drastically altered emergent circumstances, Andy’s focused on how he and his students struggled to navigate these circumstances.

Like Judy, he too noticed diminished interaction in both student-to-student and student-to-teacher contexts. He suggested that “even just having the devices in front of us” contributed to such changes. In his open-ended responses, he described students’ interactions in these contexts as “stinted.” Andy’s classroom cohesion was impacted by

such “stinted” communication and social interaction when students struggled to adjust their social behaviors and communications to a newly inter-contextual device-and-in-person classroom. He explained both his students’ and his own struggles in this regard.

If we’re looking at social skills, you know, in the terms of creating relationships—within the classroom, as a full class—I also think that [the computer’s presence] really takes the students out of the ‘full classroom experience,’ and brings it really into the front of them as ‘an individual experience set in a larger classroom,’ rather than a ‘larger classroom setting.’ And I think, again, just even having them present does that. It’s hard to hold them; it’s hard to pull them out of that ‘individual setting’ into a ‘larger class setting’ if we’re constantly going back-and-forth to ‘look at your computer, now come back, look at your computer, come back’ as opposed to it always being, you know, more of a ‘class setting.’

Interestingly, while Judy positioned the students’ increasingly individual classroom experiences as functions of students’ choices, Andy positioned these experiences as unfortunate, if only partially conscious student choices. When he said it became “hard to pull them out of that ‘individual setting’ into a ‘larger classroom setting,’” he implied both a preference for the latter setting and his role in establishing it. Juxtaposed with Andy’s observation that—following the 1:1 implementation—his students’ ability to focus “became more varied and more dependent on the task at hand, and keeping their attention on independent tasks became harder,” it is worth asking, specifically: what on or about the devices perpetually drew students from their classmates, from the “larger class setting” Andy described, from the “full classroom experience” to “the individual experience set in a larger classroom?” As his classes became less cohesively collective in nature and more individual, it is strange how students—now individually (and, it seems, voluntarily) siloed from each other—struggled to focus.

Of course, this emergent theme must be reconciled alongside the remaining three participants’ renderings of their post-1:1 implementation classrooms’ collective cohesion.

Lawrence's classroom dynamic was, emphatically, unaltered. His classroom was—uniquely within this study's context—already outfitted with desktop computers to run the engineering software that his class required. He too opined on his classroom's collective dynamics, but he did so in overwhelmingly positive terms. Like Andy, he detailed his teaching role as important to his classroom's collective identity, but he did not regard increasing personalization as a challenge to surmount. Though Judy regarded students' increased preference for personalized digital communication as unfortunate, if also conscious, and at the collective's expense, and though Andy regarded this as a fixable and dynamic student issue in a new context, Lawrence regarded these same circumstances as showing negligible or no change to his classroom's collective cohesion.

In this way, his classes' dynamics add much to this theme: to faithfully examine adverse impacts to classes' collective cohesion, one must examine contexts in which there were no impacts, minimal impacts, or positive impacts. Since Lawrence's classes' collective cohesion remained unchanged in what was already a classroom environment laden with educational technology, it is worth examining how he created this collective classroom cohesion. Lawrence explained how he created a positive, safe environment conducive to both constructive collaboration and individual productivity on students' diverse terms.

Of course, some uniquely mitigating factors affected Lawrence's post-1:1 implementation perspective. First, his students are fundamentally distinct from others at SCRHS. As Lawrence admitted during his interview, his students—who are high-achieving applicants from across Morris County subsequently accepted to “The Academy” within SCRHS—bear demonstrable aptitude for his class's subject matter. He

noted how this certainly helped to cultivate the positive aspects of his class's collective cohesion. Also, his class's subject matter is both inherently project-based and made possible by classroom technology. This extant technology immersion perhaps made the district-issued laptops less novel, and in turn gave Lawrence a deeper well of pre-1:1 implementation, educational technology experience from which he could determine best practices for his classes.

While Lawrence's classes' collective cohesion remained unchanged following the 1:1 implementation, neither Lucy's nor Jane's classes incurred as substantive changes as those felt by Judy or Andy. These participants' observed changes were negligible, incremental, moderate, or part of broader shift in student behavior independent of the 1:1 implementation. Their classes' moderate changes add perspective to the more substantive changes to Judy's and Andy's classes' collective cohesion, and to these changes' absence from Lawrence's classes.

Lucy positioned her classes' collective cohesion as constantly changing. Since she regarded students' communication and social skills as inherently flexible, the changes she witnessed to her classes' cohesion were decidedly less specific to devices. The changes she observed in her classes' cohesion were uniquely positive. She demonstrated her flexible mindset when she said that "[communication skills] is a phrase we've had to redefine in the last few years," and she proceeded to redefine how, in her classes, students have gained rather than lost skills. "I think, our kids, we don't give them enough credit as far as how they have *gained* empathy [...] just in the last few years, with things that we have been learning and things that, you know, as adults, we weren't aware of." Lucy also lauded her students' developing collaboration skills, highlighting task-delegation and

cross-site project-based work as skills “corporations are using and our students are using as well.” These effects rendered her classroom’s collective cohesion as positive: while students’ device use “increased due to higher demand of technology in class assignments,” her students’ social interactions both in student-to-teacher and student-to-student capacities “remained the same.” In these senses, her classes’ culture did not seem to retreat from a community to a single space, but from a collaborative space to a multi-contextual space that extended beyond her classes’ walls.

### *Conclusion*

This study used five participants’ data as embedded units of analysis to answer this study’s research question: what impacts to students’ communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? Three participants did not observe changes; two participants observed changes. Over the course of this chapter, five themes emerged. From the questionnaire emerged both teachers’ concerns for students’ personal device use, and teachers’ observations of students’ distraction, disengagement, hiding, and withdrawal from interpersonal contexts. From this study’s five principal participants’ collected data from three stages emerged three more themes. First, superficial similarities between participants’ student engagement definitions belied substantive differences between participants’ perspectives. Second, links emerged between participants’ student engagement definitions and observed impacts. Third, the 1:1 implementation disparately affected participants’ classes’ collective cohesion. This chapter’s findings, this study’s research question, and these emergent themes are discussed in the following chapter.

## CHAPTER FIVE

### Discussion and Implications

#### *Introduction*

This chapter discusses this study's findings and wider implications. I begin the chapter by summarizing this study's significant findings. Next, I situate these findings within the TPACK and CBAM frameworks that guide this study. Then, I link these findings to current 1:1 research literature by connecting each emergent theme to relevant studies. Following this discussion, I interpret this study's findings. After this, I discuss this study's findings' implications, and I make two recommendations for educational practice. Then, I make recommendations for future research before finishing this chapter with a reflection and a conclusion.

#### *Discussion of Significant Findings Related to the Research Question*

I conducted this study because 1:1 initiatives proliferate faster than studies examining these initiatives' effects on their principal constituents. By examining teachers' perceptions of students' communication and social skills in 1:1 contexts, I positioned prospective impacts wrought by the laptops' presence as teachers' observations of distinctly social phenomena. Though this approach is in contrast to a wide range of 1:1 studies that treat institutionally-issued laptops (or tablets) as academic innovations, this study complements extant studies focusing on the devices' academic effects. Since improving education is a holistic endeavor, studies must examine many aspects of 1:1 teaching and learning.

This study answered the following research question: what impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? This study answered this question by revealing five emergent themes. The 24 questionnaire respondents revealed two of these themes, and this study's five participants revealed the remaining three themes. Of these five participants—used in this study as embedded units of analyses—three did not observe impacts to students' communication and social skills, while the remaining two participants did observe impacts in these areas.

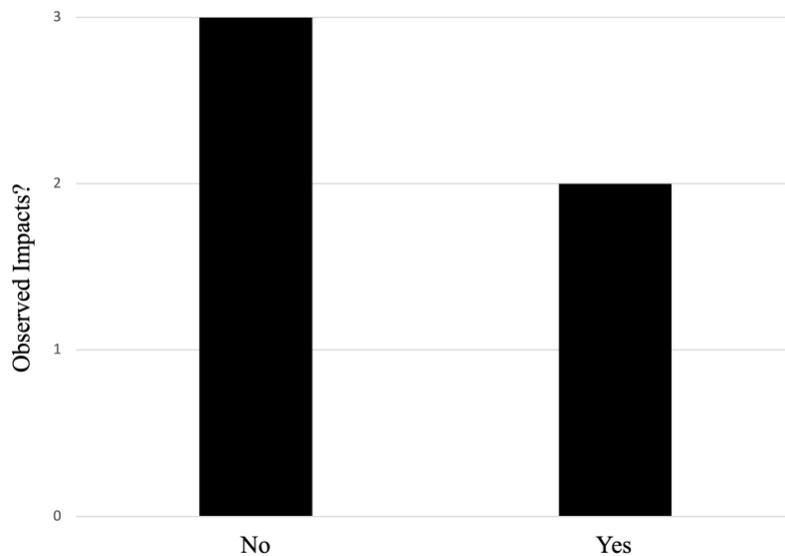
#### *Summary of Significant Findings*

This study's results revealed five themes. The first theme was "teachers' concerns regarding students' personal device use." The second theme was "teachers' observations of students' distraction, disengagement, hiding, and withdrawal from interpersonal contexts." The third theme consisted of the "superficial similarities between participants' student engagement definitions belied substantive differences between participants' perspectives." The fourth theme linked the five participants' student engagement definitions to this study's research question (whether participants ultimately observed impacts to students' communication and social skills). The fifth theme revealed the 1:1 implementation's disparate effects on participants' classes' collective cohesion.

These five participants were chosen based on their questionnaire responses and according to a maximal variation sampling strategy. Once these five participants were chosen, their semi-structured interviews were recorded (via videoconferencing software), transcribed, coded, and analyzed. Then, these five participants completed open-ended, written responses. These responses were coded and analyzed alongside the five

participants' questionnaire responses and interview transcripts to reveal the remaining three emergent themes.

Finally, I reviewed and analyzed all collected data to answer this study's central research question: what impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? To answer this question, I used each of this study's five participants as embedded units of analyses within a qualitative, bounded instrumental case study design. As seen in Figure 4.6, three of the study's participants did not observe impacts to students' communication and social skills following the district's 1:1 implementation.



*Figure 4.6.* Did participants observe impacts according to the research question?

At each of this study's data collection stages, the five participants' responses offered rich portrayals of how teachers' sensemaking transpires following a 1:1 implementation. While an overview of these results as embedded analyses may suggest

bifurcation, these results reflected a spectrum of opinion. As Table 4.7 indicates, Andy and Judy observed impacts to students’ communication and social skills.

Table 4.7

*Did Participants Observe Impacts to Students’ Communication, Social Skills?*

Andy	Jane	Judy	Lawrence	Lucy
Yes	No	Yes	No	No

After I coded participants’ initial questionnaire responses, Andy and Judy were chosen from the largest cohort of respondents: the group who noticed three negative changes in their responses to questionnaire questions one, two, and three. In this way, their orientations to the research question remained consistent with sentiments expressed in their questionnaire responses.

Lawrence was similarly consistent, but whether Jane’s or Lucy’s observations were similarly consistent is debatable. Lawrence’s lack of observed impacts to students’ communication and social skills represented a clearly consistent perspective from the questionnaire. He was chosen from the second-largest cohort of respondents: those who noticed no changes at all. Since the most opposite perspectives were best represented in my questionnaire coding and analyses, I wanted to find mitigating perspectives to represent a more diverse cross-section of teacher opinions.

Though Jane and Lucy (like Lawrence) did not observe impacts to students’ communication and social skills, their perspectives were moderated by the fact that they did notice changes to students’ communication and social skills within their questionnaire responses and their interview responses, albeit these changes were neither as numerous nor as detrimental to students as those Andy and Judy observed in their responses. In her

open-ended responses, Lucy noticed only incrementally positive, if any changes to her students' focus and student-to-student or teacher-to-teacher communication and social skills. Jane responded similarly, only highlighting (in her open-ended responses) students' personal device use as a drawback to student-to-teacher interaction. Even this observation, though, was prefaced by noting these interactions have "been the same."

I analyzed these findings within both the TPACK and CBAM frameworks. These two frameworks helped to contextualize different aspects of this study's findings. To examine teachers' individual regard for the educational technology at the center of the 1:1 implementations, I used the TPACK framework. To examine how the participants collectively regarded the 1:1 implementation as parts of an educational organization adopting an innovation, I used the CBAM.

The TPACK framework helps educational technology researchers in many ways, but it is particularly useful for examining this study's findings because it is conducive to holistically or separately examining teachers' knowledge domains in technologically immersive environments like those of 1:1 implementations. In this study it "not only helps us identify phenomena in the world, but it also gives us a language to talk about it" (Mishra & Koehler, 2006, p. 1044). With this in mind, this study's findings inherently value teachers' technological pedagogical knowledge (TPK), "teachers' knowledge of the existence, components, and capabilities of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as the result of using particular technologies" (p. 1028) by allowing its participants' disparate responses and disparate lived experiences as professionals to stand alongside one another. In essence: this study's disparate findings do not present a problem in need

of reconciliation. These findings align with the TPACK framework by respecting teachers' TPK, and by respecting their agency when they regard their classes' 1:1 environments.

The CBAM's usefulness in interpreting this study's findings is its regard for "collaborative linkage" (Hall, 1974, p. 4) between the user system and the resource system. The CBAM framework "was developed to represent the highly complex process entailed when educational institutions become involved in adopting innovations" (p. 1). It depicts a user system and a resource system linked by collaboration. In this study's case, the user system consists of SCRHS teachers adopting the students' newly ubiquitous district-issued devices. The CBAM's resource system consists of the educational innovation's knowledge base(s). In this study's case, the resource system was difficult to define. This difficulty, however, is what ultimately situates to this study's disparate findings. Traditionally, the user system may be "an individual; sometimes it is located inside the user system; more likely, however, it is a formal organization outsider the user system that forms a linkage with the user system" (p. 4). When some questionnaire respondents and some of the study's participants described students' device-related behaviors as inexplicably or disconcertingly changed, they effectively positioned the CBAM's resource system as "the students." If the CBAM stipulates that educational innovation adoption best transpires when "collaborative linkage" (p. 4) takes place between each of these systems, the vibrant yet oppositional realities present in the findings and emergent themes is sensible: the experts are the ones to whom the teachers—the canonical, contextual authority figures—are adapting. Whether the

teachers, in their user system, adopt this educational innovation is, as this study's findings suggest, variable according to each teacher.

Both of these frameworks contextualized this study's significant findings. By respecting the teachers' individuality as well as their positions within a system adopting an educational innovation, this study considered teachers' observations of impacts to students' communication and social skills. Ultimately, this study yielded five emergent themes. These themes' significant findings are presented in the following sections according to the order and means by which they were discovered.

### *Personal Device Concerns*

This study's first data collection stage's questionnaire focused on the district-issued laptops within the 1:1 implementation. While the questionnaire did not mention students' personal device use at all, many respondents nonetheless mentioned students' personal device use. Such mentions were numerous and diverse in nature: some positioned students' personal device use as utterly problematic evidence that students' communication and social skills were adversely affected by the 1:1 implementation. Some cited such problematic device use as evidence that the district's 1:1 implementation did not affect students' communication and social skills; hypothetical declines in these areas could not be declines if their diminishment predated the district's 1:1 implementation. Other respondents suggested that—since students did not clearly differentiate personal devices from the district-issued devices in communicative or social contexts—it was no longer useful to distinguish district-issued devices from students' personal devices. Still others insisted that while students used personal devices more often, so too did adults; this called into question how problematically such personal

devices could be considered. Finally, several teachers observed students' personal device use in the school's public areas as different or mildly disconcerting, if not problematic, though clearly distinct from teachers' pre-1:1 implementation renderings of students' personal device use.

Though this theme was vividly articulated by questionnaire respondents, since teachers' concerns regarding students' personal device use were diverse and contextual in nature, it was difficult to firmly situate teachers' concerns in existing research literature. Nonetheless, this emergent theme aligns with 1:1 research focused on both students within these implementations and teachers' perspectives in these contexts. Students' decisions to use or not use their personal devices—or, for that matter, any of their devices—align with what Harper and Milman (2016) described, in their literature review of 1:1 studies, as students' “buy-in,” and “off-task behaviors” among “technical challenges facing classroom technology integration” (p. 139). For example, if students perceive the district-issued devices' presence as implied consent to use their personal devices, students' commitment to the 1:1 implementation's fidelity is questionable.

At the same time, this framing is somewhat limited by its positioning students' unsanctioned personal device use as a function of teachers' abilities to successfully integrate educational technology. Any 1:1 implementation is too systemic an event to definitively situate students' personal device use this way. Mishra and Koehler (2006) commented on these judgments' difficulty when they crafted the TPACK framework. They were “sensitive to the fact that in a complex, multifaceted, and ill-structured domain such as integration of technology in education, no single framework tells the ‘complete story’” (p. 1047). In the 1:1 implementation's story, teachers' evident preoccupation with

students' unsanctioned device use could simply be a product of the technologically immersive classroom's novelty. Since 1:1 initiatives represent a substantive shift from traditional classroom dynamics, teachers need to consider how they interpret new issues that arise from devices' ubiquity to avoid becoming "gatekeepers to students' technology use throughout the school day" (Bebell & Kay, 2010, p. 16). For example, while it comes as no surprise that teachers influence students' conception of technology's value (Hallman, 2019, p. 315; Léger & Freiman, 2016, p. 64), teachers have struggled with what they perceive, perhaps erroneously at times, as students' off-task behavior in 1:1 programs (Harper & Milman, 2016, p. 139; Mifsud & Mørch, 2010, p. 199; Tallvid et al., 2015, p. 245). In this new educational paradigm, both problematic and productive device use may look—to the teacher's eye—remarkably alike.

#### *Distraction, Disengagement, Hiding, and Withdrawal from Interpersonal Contexts*

Many questionnaire respondents observed (to varied extents, and in varied contexts) distracted, disengaged students. Some described how students used their district-issued laptops to "shield" themselves from classes' in-person demands. Other respondents described how students—sometimes troublingly, other times innocuously—increasingly withdrew from in-person, social, interpersonal contexts in favor of electronic alternatives presented by their devices. Several respondents noted how students are more comfortable quietly texting classmates rather than speaking out loud, how infrequently students in groups make eye contact with one another, and how their classes' social dynamics were affected.

Like teachers' concerns for students' personal device use, these responses were difficult to situate within the 1:1 research canon. Broadly, much of what this emergent

theme entails is a function of students' engagement. Unfortunately, as is true in so many other facets of 1:1 research, existing literature's usefulness on students' engagement in 1:1 classrooms is subject to the researcher's interpretation.

Through one critical lens, obvious and occasionally hyperbolic differences between studies' scope, methodology, researcher perspective, generalizability, and nature make aligning these studies' findings maddeningly difficult. For instance: in one study focused on a Pennsylvania school district, Stone (2017) found "that, in general, students are not engaged by the 1:1 laptops as they are currently being used" (p. 2305). From this end of the spectrum, one moves incrementally to the other side: Hull and Duch (2019) found "some evidence that the laptop program affected student behavior" (p. 95). Then, with a literature review's wider lens, Harper and Milman (2016) found that 1:1 studies examining students' engagement were "inconsistent; some noted moderate change, while others noted little or none" (p. 139). At the spectrum's opposite end, Bebell and Kay (2010) found "strong evidence that student engagement increased dramatically in response to the enhanced educational access and opportunities afforded by 1:1 computing through the pilot program" (p. 21). With these differences in mind, this emergent theme's nature challenges this study's findings in another way: the private sector's pace of innovation affects educational technology both inside and outside of the classroom.

Since devices—their capabilities, their capacities, their costs—and online content change so drastically over such short periods of time, how fair is it to compare the results of, for example, 1:1 studies conducted during the nascent mobile age of 2007 or 2008 to more recent studies? Aside from the former era's technical or content-related limitations, or a district's constraints at localized implementation levels, it is also important to note

that 2007 or 2008 students were then less likely to have personal devices in their backpacks or pockets. When researchers consider students' engagement or their disengagement, their hiding or their presence, their focus or their withdrawal, they must not solely focus on the traditional classroom circumstances that students momentarily reject. They need to consider where these students go, why they go there, and what awaits them when they arrive.

If the first critical lens regards extant 1:1 research's student engagement findings as woefully inconclusive, a second critical lens regards this inconsistency as downright predictable: if implementation fidelity is, as researchers have suggested, "highly context-dependent and is heavily impacted by individual behaviors, attitudes, and perceptions" (Stone, 2017, p. 2282), varying assessments of student engagement are to be expected.

*Superficial Similarities Between Participants' Student Engagement Definitions Belied Substantive Differences Between Participants' Perspectives.*

Though 1:1 implementations affect teachers differently according to many factors, it is important to solicit teachers' opinions on how these implementations influence (or do not influence) their craft. Since "educational technology has been positioned as a new paradigm in education, the degree to which teachers reflect this shift [...] is an important factor to measure in considering outcomes and sustainability" (Gherardi, 2017, pp. 166–167). Localized 1:1 implementations vary in their scope, scale, and desired outcomes, but school or district-level 1:1 implementations represent systemic changes inextricable from their immediate circumstances (Stone, 2017, p. 2282). In such localized and systemic scenarios, evaluating teachers' observations is critical both to initiatives' successes

(Hallman, 2019, p. 315) and critical to further research in that it bolsters the credibility of teachers' voices.

To take teachers' observations seriously by conducting research that centralizes their perspectives is to respect their agency. These teacher voices are uncovered through thorough research. While this study's five participants' student engagement definitions revealed some similar aspects of their shared experiences following the district's 1:1 implementation, substantive differences emerged. Since teachers' educational technology beliefs weigh heavily on 1:1 implementations' outcomes, studying these beliefs is essential, as "institutional realities (e.g., beliefs, norms, and power structures) matter as much as teachers' and administrators' individual proclivities, knowledge, and skills when engaging in technology integration efforts despite what seemed the inattention paid by the administration to these issues." (Lamb & Weiner, 2018, p. 1). Since teacher beliefs are so impactful, once uncovered, they must be oriented toward educational outcomes.

#### *Links Between Student Engagement Definitions and Observed Impacts*

This study's links between participants' definitions of student engagement and their observed impacts to students' communication and social skills align with 1:1 studies that highlight the importance of teachers' beliefs. Participants' varied student engagement definitions meant that some considered student engagement a more contextually amorphous construct than others. When this variability was linked to whether or not participants observed impacts, this squared with 1:1 literature's emphasis on teachers' beliefs, as these influence the effectiveness of 1:1 implementations (Penuel, 2006, p. 336; Warschauer et al., 2014, p. 58). If teachers' beliefs are particularly rigid or traditional in nature, to implement a 1:1 initiative is to ask these teachers "to adopt two innovations—

the one-to-one computing environment and a more student-centered classroom” (Donovan et al., 2007). Alternatively, when 1:1 teachers adopt a flexible mentality, they avoid feeling “unprepared, frustrated, and out of their comfort zone” in early implementation stages (Storz & Hoffman, 2013, p. 14).

### *The 1:1 Implementation’s Disparate Effects on Classes’ Collective Cohesion*

This emergent theme examined how participants regarded their classes as collective units and the extent to which the district’s 1:1 implementation affected these collective units’ cohesion. Classroom cultures are inherently variable, and when participants reflected on the extent to which the district-issued devices affected their classes’ collective cohesion, their responses comprised a wide spectrum of perspectives. When a given class’s myriad norms, mores, and customs are combined, they start to represent distinct cultures. Educators understand how these dynamics vary not just between teachers, grade levels, or subject matter, but even between classes otherwise demographically similar. When the classes’ collective cohesion is evaluated in this context, this theme aligns with 1:1 research on the nature of cultures’ changes. Hull and Duch (2019) suggested 1:1 implementations’ culture change at the district level. “The first-order change was giving every student a laptop. Second-order change involves a deeper level of transformation” (p. 95). Such transformation transpires when once-isolated hunches, trends, and observations coalesce into emergent themes, decipherable by 1:1 research examining how classes change when each student is issued a device.

### *Interpretation of Findings*

These findings help to fill several important gaps in 1:1 research studies. The first and most glaring of these gaps is a dearth of 1:1 studies examining this student-to-device

distribution ratio's nonacademic effects as social, emotional, interpersonal, and cultural phenomena. Though only two of five participants in this study observed impacts to students' communication and social skills, the observed impacts were striking. This study's findings discuss the 1:1 implementation not as an academic intervention by which progress is then measured, but instead as a socio-educational change agent that affects how schools look, feel, and sound.

The second gap this study's findings help to fill is that comprising the lack of 1:1 research that values teachers' observations irrespective of demographic or occupational identifiers. Apart from the study's requirement that participating teachers have been in the district since the beginning of the 1:1 initiative, this study did not collect or analyze teachers' years of experience. This study did not collect or analyze teachers' ages, levels of education, previous work experiences, or their self-conception of educational technological competency. While it is certainly valuable to study how 1:1 implementations affect teachers' pedagogy or students' learning according to teachers' academic discipline, or according to students' ages, these studies' generalizability is often limited to these very domains. This study's findings comprise teachers' juxtaposed, disparate observations. Their radically different experiences reflect the working realities of their shared vocation. These opinions make 1:1 research more informed.

The third gap in the literature this study's findings help to fill is perhaps perpetually ongoing research conversation as to what, exactly, constitutes student engagement, communication skills, and social skills? Irrespective of 1:1 research, the teachers' definitions and exemplifications of these terms contribute to an everchanging understanding of these terms' parameters. As the very notion of school as a social, fixed

space stretches, teachers need to work through these terms on their own terms. This study's findings suggest that what one teacher values as a student's demonstrably focused work ethic, another regards as withdrawal from traditionally social circumstances. By defining these terms, this study's findings help researchers to understand how teachers perceive others: those as simple as "good work," "off-task behavior," "sociability," and "collaboration" may be endlessly complex.

### *Implications and Recommendations for Educational Practice*

This section begins with discussions of this study's results' three implications. First, this study's results suggest disparate 1:1 classroom cultures coexist within the same school. Second, this study's results suggest teachers' understandings of student engagement in 1:1 contexts are complex. Third, this study's results suggest that even if teachers believe schools must develop students' communication and social skills, teachers' beliefs as to how or if these skills develop in a 1:1 implementation may differ considerably.

This section concludes with two recommendations for educators operating in 1:1 contexts. First, I recommend professional development focused on 1:1 classrooms' social dynamics could help teachers understand the disparate social circumstances of 1:1 education. Second, I recommend educational administrators open up device use dialogues among staff and students. Such openness could contribute to a more relevant education for students learning in 1:1 environments.

### *Implications*

First, this study's results suggest disparate 1:1 classroom cultures coexist within the same school. The 1:1 implementation disparately affected teachers' classes' collective

cohesion. While some of this study's questionnaire respondents and participants depicted students' device use as essential to schools' educational imperative, others regarded students' device use as disruptive. This emergent theme—coupled with teachers' concerns regarding students' personal device use—suggests students navigate different 1:1 classroom cultures within the same school day, as each of their teachers' device use norms, communication preferences, and social expectations differ from one class to another. For instance: some questionnaire respondents and study participants did not often ask their students to use the district-issued laptops, while other teachers' students regularly used these devices. Teachers also ascribed different values to similar student behaviors: some teachers lauded students' electronic collaboration prowess, while others noted such collaboration comes at in-person collaboration's expense. These disparate classroom cultures could confuse students.

Second, this study's results suggest teachers' understandings of student engagement in 1:1 contexts are complex. Since outwardly observable, physical demonstrations of student engagement in a 1:1 classroom may look much like disengagement, teachers may struggle to distinguish whether or not a student is engaged. In this way, some 1:1 teachers—formally or informally, consciously or unconsciously—may measure student engagement according to students' device-centered task adherence. Some existing research echoes these complexities. In a study examining a 1:1 implementation's effect on middle school students' engagement, Donovan et al. (2010) evaluated student engagement according to students' on- and off-task behavior. Though that study's results ultimately did “not support the notion that increased access to technology leads to increased engagement in the K–12 setting” (p. 437), the researchers could “categorically

state that access to technology often increases motivation to use the technology” (p. 438). Those conclusions suggested a difference between students’ device engagement as opposed to their task engagement, and this study’s results similarly suggests such complexities exist within teachers’ perceptions of student engagement in 1:1 contexts.

Third, this study’s results suggest that even if teachers believe schools must develop students’ communication and social skills, teachers’ beliefs as to how or if these skills develop in a 1:1 implementation may differ considerably. Since researchers found teachers’ educational technology and pedagogy beliefs contributed to 1:1 initiatives’ effectiveness (Penuel, 2006, p. 336; Warschauer et al., 2014, p. 58), developing a better understanding of the points at which these beliefs overlap and diverge improves future 1:1 implementations. In this study’s questionnaire responses, participant interviews, and open-ended responses, teachers observed students’ diminished communication and social skills following the district’s 1:1 implementation. Alternatively, other teachers did not notice this diminishment, and still others praised students’ development in these regards. This spectrum of opinion suggests teachers’ regard for educational technology’s importance to communication and social skills varies widely.

### *Recommendations*

Post-implementation 1:1 districts and schools should adopt professional development focused on 1:1 classrooms’ social dynamics. Perhaps the most intriguing implication of this study’s findings is how similarly or differently teachers perceived deceptively similar phenomena. Teachers deserve to experience these cross-departmental 1:1 connections for themselves; comparing experiences yields a more nuanced understanding of how similarly or differently 1:1 classes can operate. Since this study

focused on teachers' observations of changes to students' communication and social skills rather than pedagogy, learning, evaluation, or educational outcomes, this study includes little discussion of professional development's essential role in 1:1 implementations' fidelity. However, this is also because precious little professional development focuses on teachers' regard for students' communication and social skills.

Ongoing, academic discipline-agnostic, teacher sensemaking opportunities focused on 1:1 classrooms' social dynamics are recommended. Such sessions would allow teachers to share not only their educational best practices, but their experiences with how their classrooms change. This study's findings suggest cross-disciplinary learning experiences are particularly valuable. Learning from fellow professionals who inevitably approach teaching and learning from a different position can open minds to elicit teachers' flexibility and pragmatism.

Administrators in 1:1 schools should initiate and cultivate ongoing device use dialogues among faculty, staff, students, and parents. The absence of device use norms—outside of use policies prohibiting the most inappropriate device-related behavior—affects teachers and students. Teachers may chide students for using their phone in academic environments, but some teachers also struggle to manage their device use, as particularly keen students are sure to suggest from time to time. Several participants expressed their unease when students were unable to discern whether they should use with teachers the informal diction they use in private messages to friends and family. Just as yesterday's elementary school students learned to write in cursive and properly address envelopes, just as high school students write "To Whom It May Concern," at the top of a

mock cover letter, students will likely learn these skills whether teachers deem them valuable or not. The question is whether teachers take on this responsibility.

These questions of propriety or politeness can be difficult and awkward, and they may reveal sociodemographic fault lines. These, incidentally, are precisely the reasons why teachers should be having these discussions: schools provide the controlled environments necessary for all parties to make sense of the device-laden environments that schools provide. As the world becomes more individually expedient, the school may be one of the last bastions of social development. While it may be tempting for administrators to create norms and policies that codify device-related behaviors, this study's results suggest teachers' individual mindsets, circumstances, teaching styles, and competencies render top-down messaging of this nature less effective than allowing teachers to establish their own cohesive, collective cultures within their classrooms. Once these classroom-level device use conversations are regularly taking place and teachers establish a rapport with their students and microcultures in their classrooms, more complex dialogues can take place. These conversations can be pointed toward an ideal balance between screen time and in-person learning during classes, online privacy, and which contexts and circumstances are most conducive to teaching and learning in-person as opposed to via electronic device.

#### *Recommendations for Future Research*

There is an overarching, desperately urgent need for a great deal of high-quality scholarship on how COVID-19 has affected K–12 students. Though much attention has recently been paid to the social and emotional consequences suffered by students learning virtually, this research must uncover—through deep analyses—how students and teachers

regarded their scholastic social and emotional experiences at school before the COVID-19 pandemic, during the pandemic, and (as of this writing, hopefully) after the pandemic. Not nearly enough attention has been paid to the diversity, frequency, or quality of students' social experiences in technologically immersive contexts. While forthcoming scholarship should focus on these student-focused indices as soon as possible, this research must not leave out teachers' ongoing observations and understandings of students' communication and social skills. As the COVID-19 pandemic has still further stretched the boundaries of school's constitution, researchers should focus on how it was already stretched. They must uncover what can be done to optimize post-pandemic education in an increasingly technologically immersive world.

### *Personal Reflection*

I chose this study's focus after a student off-handedly said to me, as he exited my classroom following last period English class, "I like this class because we actually talk in it." When I asked him what he meant by this, he explained how most of his classes worked like this: he sat down, the teacher digitally distributed his assignment, he looked up the answers to the assignment on the internet, he submitted the assignment, he listened to some music in his headphones, he watched videos about stuff he liked, and then he left to repeat this routine in a different classroom. Since high school seniors have somewhat of a penchant for drama and hyperbolic end-of-school-day declarations, I endeavored to find out just how true this student's assertion was. I asked countless students how they used their laptops during their other classes. I surveyed my classes in different ways, and I asked them how frequently they go through an entire school day without speaking.

As it turns out, there was a fair bit of drama in my student's characterization of his daily educational routine. Still, I did not discover enough drama to stop me from asking more questions. I understood how my district's 1:1 implementation affected the students in my classroom, but as for how school itself changed following our district's 1:1 implementation, I had no idea. Now, I have a better idea, but I am still filled with questions as to how different teachers, different students, in different places process changes wrought by 1:1 implementations. I want to know, for instance, how 1:1 implementations affected teachers whose classes over the past year became entirely remote on as little as a day's notice in some places.

I wanted to talk to as many teachers as I could to figure out how students' school lives are changing, but also how teachers adapt to these changes. At risk of naïveté or navel-gazing, it is continually incredible to me how a construct so seemingly stable as the school manifests so differently to professional educators in the same school. If anything, this innate diversity in successful professionals speaks to teachers' cleverness, observational prowess, resiliency, and nearly endless pragmatism: all of which have, of course, been tested beyond anyone's most imaginative prospects since March of 2020.

On this: assuming it is one day safe to return to school, I eagerly await—along with legions of students—being back in the veritable crucible of sociability that is a public high school. This study helped me to uncover just how true this depiction of high school was before the COVID-19 Pandemic closed schools. Before students left, there was an unspoken expectation that when parents sent their children to school each day, these children would, on arrival, speak and interact with their teachers and the other children they met. However, when teachers—even if only some teachers—describe

students' devices drawing them away from the people around them into an all-encompassing, electronic, individualized paradigm, it is worth asking to what extent this portrait accurately represented most students' high school experiences.

### *Conclusion*

This study answered a central research question: what impacts to students' communication and social skills did high school teachers observe after their school district implemented a 1:1 student-to-device program? Using a questionnaire, semi-structured participant interviews, and open-ended participant responses, this study answered the research question by explicating these impacts within five emergent themes. First, this study's questionnaire revealed teachers concerned with students' personal device use. Second, this study revealed teachers' observations of students' distraction, disengagement, hiding, and withdrawal from interpersonal contexts. Third—from this study's five selected participants' questionnaire responses, interviews, and open-ended responses—this study revealed how superficial similarities between participants' student engagement definitions belied substantive differences between these participants' perspectives. Fourth, this study revealed links between participants' student engagement definitions and observed impacts to students' communication and social skills following the district's 1:1 implementation. Fifth, this study revealed disparate effects on participants' classes' collective cohesion.

These answers to this study's research question add to the 1:1 literature by focusing on a 1:1 implementation's social—rather than academic or pedagogical—consequences. This focus elicited just how disparately 1:1 implementations affect teachers within the same school. Such considerable differences related to teachers'

perceptions of student engagement, students' communication skills, and students' social skills, combined with teachers' differing regards for appropriate educational technology deployment suggest 1:1 implementations' complexity requires ongoing academic study. This study examined how teachers regard both their students' and their own roles, feelings, and behaviors; it examined how these are changed by increasingly immersive educational technology. This study's findings allow policymakers to actuate more informed decisions regarding the extent to which electronic devices are essential in 1:1, K-12 education.

## APPENDICES

## APPENDIX A

### Questionnaire: Consent Form

# Research Study: Questionnaire #1

Hi!

This research study forms the basis of my dissertation, and it would help me immensely if you could participate in this study by completing this questionnaire.

A consent form outlining this research study's scope and content is attached. Carefully read this form before proceeding.

Questions #1–#4 ask for identifying information. Your responses to these questions and the others on this form are anonymized, protected, and stored securely on a cloud-based server unaffiliated with the [REDACTED] Regional School District.

Finally, if you have any questions at all, please do not hesitate to reach out to me via email at this address:

[Cristofer\\_Slotoroff1@baylor.edu](mailto:Cristofer_Slotoroff1@baylor.edu)

Thank you!

\* Required

#### 1. YOUR CONSENT

##### SIGNATURE OF SUBJECT:

By clicking "I Agree," you are providing consent to be in this study. I have given you a copy of this document for your records; it is attached to the email containing the link to this form. I will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact me via email: [Cristofer\\_Slotoroff1@baylor.edu](mailto:Cristofer_Slotoroff1@baylor.edu) \*

*I understand what the study is about and my questions so far have been answered.*

- Yes; my questions have been answered and I agree to take part in this study.
- No; I do not wish to take part in this study.

Submit

## APPENDIX B

### Questionnaire: Demographic Questions

2. Please list your first and last name.

[if you do not list your first AND last name, your responses on this form will be discarded] \*

Enter your answer

3. Please list a personal email address (not your @ [REDACTED] address) that you check frequently. If you are chosen to participate further in this study, this email address will be used to contact you. \*

Enter your answer

4. Please list your academic department. (for example: "world languages;" "English language arts," "physical education," etc.) \*

Enter your answer

---

## APPENDIX C

### Questionnaire: Content Questions

5. BEFORE the onset of the COVID-19 pandemic, what changes did you observe IN YOUR CLASSROOM or INSTRUCTIONAL SPACE regarding your students' communication and social skills since the 1:1 device program's\* implementation in 2017-2018?

\* "1:1 device program" refers to the district issuing one laptop to each student at a 1:1 ratio. \*

Enter your answer

6. BEFORE the onset of the COVID-19 pandemic, what changes did you observe regarding your students' communication and social skills in the school's PUBLIC AREAS (e.g., hallways, library, cafeteria) since the 1:1 device program's implementation beginning in 2017-2018? \*

Enter your answer

7. Based on your observations, what are the 1:1 device program's overall effects (if any) on the quality or nature of students' social interactions and communications? \*

Enter your answer

8. Is there anything else you'd like to write about 1:1 learning and students' communications or socialization?

Enter your answer

Submit

## APPENDIX D

### Open-Ended Sentence Stems 1–2

# Research Study: Open-Ended Sentence Stems

Please complete the following open-ended sentence stems. Your responses can be as brief or as thorough as you see appropriate.

\* Required

1. From the beginning of the 1:1 implementation until the pandemic forced us out of school, my students' ability to focus... \*

Enter your answer

2. From the beginning of the 1:1 implementation until the pandemic forced us out of school, my students' device\* use... \*

*\* device = laptop computer, cell phone, tablet, etc.*

Enter your answer

## APPENDIX E

### Open-Ended Sentence Stems 3–6

3. From the beginning of the 1:1 implementation until the pandemic forced us out of school, my students' communication and social interactions with other students... \*

Enter your answer

4. From the beginning of the 1:1 implementation until the pandemic forced us out of school, my students' communication and social interactions with me... \*

Enter your answer

5. Assuming the COVID-19 pandemic subsides at a future point and conditions allow for school to resume to a pre-pandemic extent, my concerns regarding my students' ability to focus are... \*

Enter your answer

6. Assuming the COVID-19 pandemic subsides at a future point and conditions allow for school to resume to a pre-pandemic extent, my concerns regarding my students' overall communication and social skills are... \*

Enter your answer

## APPENDIX F

### IRB Approval Exemption Request Email

Good afternoon,

My name is Cristofer Slotoroff, and I am a doctoral candidate in Baylor University's Ed.D. (Learning and Organizational Change) program. I am writing to ascertain whether my dissertation is exempt from IRB approval.

#### **Title**

Examining Teachers' Understanding of the Relationships between 1:1 Computing and High School Students' Social Experiences: A Qualitative Case Study

#### **Purpose**

This study explores the social impacts felt by high school students learning in a 1:1 student-to-device environment. The study fulfills this purpose by examining teachers' perceptions of the 1:1 program's effect on students' social dynamics alongside the district's device-based metadata.

#### **Data Collection**

Data will be collected using the following strategies:

- Multiple questionnaires utilizing open-ended questions
  - The first questionnaire will be sent to those high school teachers who meet the conditions that warrant inclusion in the study. Responses are to remain confidential to protect respondents. This questionnaire is designed to elicit further, meaningful participation in the study by asking teachers to reflect on the extent to which the introduction of computers has changed social dynamics amongst students. The study seeks to find 4–6 teachers willing to be interviewed.

- Additional questionnaires are to be sent only to those teachers participating in interviews.
- Multiple rounds of interviews to be conducted with those participants fulfilling criteria ascertained, in part, via aforementioned questionnaire responses
  - Recorded interviews are designed to elicit emergent themes according to maximum variation sampling.
  - Interviews are conducted on-site in a teacher's classroom, an off-campus site according to the preference of the participant, or (as a result of the COVID-19 pandemic) via videoconferencing software, the resulting video file to be stored securely away from the school's server.
- Thorough review and exploration of existent device use data previously logged by the research site's (i.e., the school district's) IT staff (as per their standard practice) to find emergent themes.
  - The extent, scope, and nature of device use data to be included in this study is dependent upon the issuing body's permissions.
  - Metadata is anonymized.
  - Students' individual device use is *not* included in this study.
  - Device use data informs the scope and nature of researcher inquiries as well as material to be included within questionnaires and interviews.
- This study is undertaken with the goal to ensure participants' confidentiality and the integrity of data.
  - All participants who agree to take part in this study will sign and date both consent forms and confidentiality agreements.
  - Participants' consent is to be documented and reaffirmed at ongoing intervals (e.g., before responding to a questionnaire, before engaging in a recorded interview, etc.).
  - All materials pertaining to the study are to be password protected.
  - Data is stored in password-protected, cloud-based storage. No identifiable information is to be used in the reporting of the data.

## APPENDIX G

### IRB Exemption Approval Email Response



IRB

Archive - Exchange June 23, 2020 at 12:13 PM

Re: IRB Inquiry

To: Sotoroff, Cristofer, Cc: Howell, Leanne, Talbert, Tony, Renbarger, Rachel

[Details](#)

---

Hello Cristofer,

Thanks for reaching out. Your study does not qualify as human subjects research because the results of the study would not be generalizable to a broader population due to only having 4-6 participants. Thus, you do not need to submit any documentation into our office. Though your project does not fall within regulations, you are still required to conduct your study ethically, as discussed in the [Belmont Report](#). Attached is our guidance booklet if you have questions about determinations. Let me know if you have any questions.

Best regards,  
Jessica Trevino

---

## APPENDIX H

### Participant Consent Form

**BAYLOR UNIVERSITY**  
**Department of Curriculum and Instruction**

#### Consent Form for Research

**PROTOCOL TITLE: Examining Teachers' Understanding of the Relationships between 1:1 Computing and High School Students' Social Experiences: A Qualitative Case Study**

**PRINCIPAL INVESTIGATOR: Mr. Cristofer Slotoroff**

#### **Invitation to be Part of a Research Study**

You are invited to be part of a research study. This consent form will help you choose whether or not to participate in the study. Feel free to ask if anything is not clear in this consent form.

#### **Important Information about this Research Study**

Things you should know:

**The purpose of the study is to explore teachers' perceptions of the social impacts felt by high school students learning in a 1:1 student-to-device environment.**

- **In order to participate, you must fulfill BOTH of the following two criteria:**
  - You are currently a full-time teacher at [REDACTED] High School [REDACTED].
  - You have been teaching within the [REDACTED] School District [REDACTED] since the beginning of the district's 1:1 initiative at the start of the 2017–2018 academic year.
  
- **If you choose to participate, you will be asked to:**
  - complete at least one, but no more than three questionnaires emailed to your [REDACTED] account.
  - If your responses satisfy the study's purposive sampling model, you may be among 4–6 participants chosen for two rounds of individual, semi-structured interviews to be conducted either in-person (conditions permitting as per COVID-19) at a comfortable location of your choice or via videoconferencing software (e.g., Zoom, FaceTime, Google Meet).
  
- Questionnaires consist of open-ended questions that are designed to be completed in approximately 15–60 minutes.
- Interviews are designed to last approximately one hour, and—if conducted via videoconferencing software—these will be recorded.

- This study poses no risks to your health outside those present in ordinary life.
- There is no direct benefit to this study's participants.
- Taking part in this research study is voluntary. You do not have to participate, and you can stop at any time.

**More detailed information appears later in this form. Please read this entire document and ask questions before participating in this research study.**

**Why is this study being done?**

**The purpose of this study is to examine how immersive computing affects students' social interaction at school. The study fulfills this purpose by studying how several [REDACTED] School [REDACTED] teachers perceive social changes wrought by the 1:1 program.**

- I am exploring how the 1:1 model has affected the way students congregate, participate, and interact with one another as understood by a cross-section of teachers.
- I am examining teachers' perceptions of the 1:1 program's effect on students' social dynamics alongside the district's device-based metadata.
- To accomplish this, I am collecting data via questionnaires, interviews (in-person and using videoconferencing software), and anonymized device-use data that the district already collects.

**What will happen if I take part in this research study?**

PARTICIPATION TIMELINE		
WHO?	HOW MUCH TIME?	WHEN?
<b>TASK 1 Participants ONLY</b> (most participants)	Approx. <b>15–30 total minutes</b> of your time.	<b>October or November, 2020</b>
<b>TASKS 1–5 Participants</b> (4–6 teachers)	Approx. <b>2–4 total hours</b> of your time.	<b>October or November, 2020 through March, 2020</b>

**TASK 1) 1<sup>st</sup> Questionnaire:** Participants will complete an initial questionnaire focused on students' social interactions both before and after 1:1 learning. (Est. Time: 15–30min.)

**TASK 2) 1<sup>st</sup> Interview:** 4–6 teachers will be selected to participate in an interview conducted either in person at a location of participant's choice or via video conferencing software according to participant preference/COVID-19 restrictions. (Est. Time 30–60min.)

**Task 3) 2<sup>nd</sup> Questionnaire:** Previously-selected 4–6 selected teacher participants will complete a second questionnaire. (Est. Time 30–60min.)

**Task 4) 2<sup>nd</sup> Interview:** 4–6 participants will complete a second interview. (Est. Time 30–60min.)

**Task 5) Participant Debrief:** Participants will debrief to ensure they are well-informed as to the research process's final steps. (15–30min.)

#### RECORDING DISCLOSURE

All participant interviews will be recorded. **This recording process is required for these 4–6 participants** in the study. If you do not want to be recorded, you can still be in this study, but you may not participate past **TASK 1** (listed above).

Recordings are made to ensure that participants' responses are accurately represented in the research study. Recordings are confidential, and will not be shown or disseminated to any outside sources (like other study participants).

#### INTERVIEW PROTOCOL

If interviews can be conducted **in-person**, I will make an audio recording of your interviews.

If interviews are conducted via **videoconferencing software**, I will make a video recording of your interviews.

**You will indicate your decision at the end of this form.**

### How many people will be in the study?

If you wish **only** to participate in **TASK 1** by answering the initial questionnaire...

- your participation in the study **begins** when you respond to the questionnaire.
- your participation in this study **ends** when you submit this questionnaire.
- the questionnaire will be emailed to your school email address in Oct. or Nov., 2020.

If you wish to be among the 4–6 teachers who complete **the entirety** of the study...

- your participation consists, in total, of:
  - **two questionnaires**
  - **two interviews**
  - **one debriefing**
- your participation **begins** when you respond to the first questionnaire.
- your participation **ends** upon the debriefing.
- the questionnaire will be mailed to your school email address in Oct. or Nov., 2020
- the second questionnaire and two interviews will take place intermittently at agreed upon, convenient times for both participants and researcher
  - from **November, 2020**, (approximately)
  - to **March, 2021**.

I am soliciting as many qualifying teachers as possible to complete TASK 1 of the study.

- Ideally, 30–50 teachers provide responses to the initial questionnaire.
- 4–6 teachers complete all of TASKS 1–5

**TOTAL PARTICIPANT POPULATION:** Between 30–50 teachers.

### What are the risks of taking part in this research study?

There are no known risks to participants in this research study.

### Are there any benefits from being in this research study?

Although you will not directly benefit from being in this study, others might benefit because this study seeks to understand a complex and underexamined socio-educational dynamic. What knowledge this study yields will be a valuable addition to the research canon.

### How Will You Protect my Information?

I will keep the records of this study confidential by...

- storing all data on a secure, password-protected, cloud-based server unaffiliated with the [REDACTED] District.
- anonymizing and randomizing identifiable personal data whenever possible.
- destroying the study's raw data after **three years**.

I will make every effort to keep your records confidential. However, there are times when federal or state law requires the disclosure of your records.

The following people or groups may review your study records for purposes such as quality control or safety:

- Representatives of **Baylor University** and the **BU Institutional Review Board**
- **Federal and state agencies** that oversee or review research (such as the HHS Office of Human Research Protection or the Food and Drug Administration)

The results of this study may also be used for **teaching, publications, or presentations at professional meetings**. If your individual results are discussed, **your identity will be protected** by using a code number or pseudonym rather than your name or other identifying information.

While the researcher will follow strict protocols to guard your confidentiality, no data is 100% secure from security breaches. If in the event data becomes compromised, the researcher will notify the affected participants of the nature and extend of the breach.

#### **Will I be compensated for being part of the study?**

You will not be paid for taking part in this study.

#### **Are there any costs to me to be part of the study?**

There are no costs to those who choose to take part in this study.

#### **Is it possible that I will be asked to leave the study?**

The researcher may take you out of this study without your permission. This may happen because:

- The researcher thinks it is in your best interest
- You cannot meet the study's logistical requirements (deadlines, interviews, etc.)

- Other administrative reasons

### **Your Participation in this Study is Voluntary**

Taking part in this study is your choice. You are free not to take part or to withdraw at any time for any reason. No matter what you decide, there will be no penalty or loss of benefit to which you are entitled. If you decide to withdraw from this study, the information that you have already provided will be kept confidential. You cannot withdraw information collected prior to your withdrawal.

### **Contact Information for the Study Team and Questions about the Research**

If you have any questions about this research, you may contact:

Mr. Cristofer Slotoroff

Phone: [REDACTED]

Email: Cristofer\_Slotoroff1@baylor.edu

Or

Dr. Leanne Howell (Faculty Dissertation Advisor: Baylor University)

Email: Leanne\_Howell@baylor.edu

### **Contact Information for Questions about Your Rights as a Research Participant**

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the following:

Baylor University Institutional Review Board

Office of the Vice Provost for Research

Phone: 254-710-3708

Email: [irb@baylor.edu](mailto:irb@baylor.edu)

### **Your Consent**

**SIGNATURE OF SUBJECT:**

By signing this document\*, you agree to be in this study. You will receive a copy of this document for your records. I will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

*I understand what the study is about and my questions so far have been answered. I agree to take part in this study.*

\_\_\_\_\_  
Signature of Subject

\_\_\_\_\_  
Date

*\* If administered digitally, by clicking "I Agree" you are providing consent to be in the study."*

**CONSIDERATION FOR INTERVIEW PARTICIPATION  
DURING WHICH YOU WILL BE AUDIO/VIDEO RECORDED:**

By checking yes below\*, I agree to be considered for interviews. During these interviews, I consent to being audio/video recorded.

YES \_\_\_\_\_ NO \_\_\_\_\_ Initials \_\_\_\_\_

*\* If administered digitally, by clicking "Yes" you are providing consent to be considered for interviews. During these interviews, you are providing consent to be audio/video recorded.*

APPENDIX I

Board of Education Minutes: Research Study Approval

[REDACTED] DISTRICT  
BOARD OF EDUCATION

[REDACTED] [REDACTED] [REDACTED]

EXTRACT FROM THE MINUTES OF A MEETING OF THE  
[REDACTED] DISTRICT BOARD OF EDUCATION  
AS RECORDED IN THE OFFICIAL MINUTES

The Board of Education of [REDACTED] District in the County of Morris, New Jersey, convened in Regular Session on Monday, September 21, 2020, at 7:00 p.m. in the [REDACTED] High School Auditorium, [REDACTED] New Jersey.

The following members of the Board of Education were present:

[REDACTED]

The following members of the Board of Education were absent: [REDACTED]

The following resolution was offered by [REDACTED] seconded by [REDACTED] and adopted by the Board of Education on a roll call vote:

C: CURRICULUM, EXTENDED EDUCATION, ATHLETICS, AND STUDENT ACTIVITIES COMMITTEE ITEM 4A

**RESOLVED:** Consider approval of Teacher Research Proposal

- a. Participant Consent Form

STATE OF NEW JERSEY)  
COUNTY OF MORRIS) ss

I, [REDACTED] School Business Administrator and Board Secretary of the [REDACTED] District Board of Education, in The town of [REDACTED] County of Morris, State of New Jersey, hereby certify that the foregoing extract from the minutes of the meeting of the Board of Education of said district duly called and held on September 21, 2020, has been compared by me with the original minutes of said [REDACTED] Regional District Board of Education and is a true, complete copy thereof and of the whole of said original minutes so far as the same relate to the subject matter referred in the said extract in witness I have hereunto set my hand and affixed the corporate seal of said Board of Education this 11<sup>th</sup> day of May 2021.

[REDACTED]

Board Secretary



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