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The Intersection between 1:1 Laptop Implementation and the Characteristics of Effective Middle Level Schools

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Abstract

The number of middle level schools adopting 1:1 laptop programs has increased considerably during the past decade (e.g., Lowther, Strahl, Inan, & Bates, 2007; Storz & Hoffman, 2013; Texas Center for Educational Research, 2009). The cornerstone practices of the middle school concept (National Middle School Association, 2010), therefore, often serve as the backdrop for 1:1 implementation. The purpose of this qualitative study was to examine the intersection between 1:1 program implementation and the characteristics of effective middle schools associated with the middle school concept over a four-year period. Through ongoing participant observation, individual interviews, focus groups, and reviews of digital student work and documents, we explored the implementation of a 1:1 program by one middle school team that also espoused the middle school concept. We begin by providing perspectives on 1:1 programs and on the middle school concept from research and theoretical lenses. We then describe the qualitative methodology we employed to conduct this study. Next, we present an analysis of our findings, illustrating the opportunities, tensions, and trajectories that appeared when we examined 1:1 implementation alongside the characteristics of effective middle level schools. Finally, we explore the implications of these findings for middle level educators, school leaders, and other stakeholders as they adopt 1:1 programs in schools for young adolescents.

Keywords: middle school concept, technology integration, 1:1 computing

Introduction

The number of schools adopting 1:1 computing programs in which each student has access to his/her own Internet-enabled device has increased considerably over the past decade (Lowther, Strahl, Inan, & Bates, 2007; Project Tomorrow, 2014; Storz & Hoffman, 2013; Texas Center for Educational Research, 2009). As digital technology becomes more affordable and as communities recognize the importance of educational technology, proponents assert that providing students with ubiquitous access to computing devices holds great promise for personalized instruction and enriched curriculum

(Hansen, 2012). One-to-one programs are particularly abundant in the middle grades (e.g. Lowther et al., 2007; Storz & Hoffman, 2013; Texas Center for Educational Research, 2009), when young adolescents demonstrate a strong affinity for technology and reflect in their own lives the technological changes occurring in their cultures and communities (Bishop & Downes, 2013; Project Tomorrow, 2014).

Because 1:1 initiatives are increasingly prevalent in the middle grades, they may often be implemented concurrently with the middle school concept. In its seminal position statement, *This We Believe: Keys to Educating Young Adolescents*, National Middle School Association (NMSA, now Association for Middle Level Education [AMLE]) outlined the middle school concept by grouping the characteristics of effective middle level schools into three categories: (1) Curriculum, Instruction, and Assessment; (2) Leadership and Organization; and (3) Culture and Community (NMSA, 2010). Because the success of implementing both the middle school concept and 1:1 initiatives hinges on similar components, such as collaborative decision making and responsive school structures, educators might benefit from a deeper understanding of the ways in which characteristics of the middle school concept intersect with the implementation of effective 1:1 programs.

The purpose of this qualitative study was to examine over a four-year period the intersection between 1:1 program implementation and the characteristics of effective middle level schools. The research was guided by the following questions:

1. How does 1:1 program implementation intersect with the characteristics of effective middle level schools?

2. What tensions and opportunities arise when teachers committed to effective middle level practices confront the challenges of 1:1?

We begin by providing perspectives on 1:1 programs and on the middle school concept from research and theoretical lenses. We then describe the qualitative methodology we employed to conduct this study. Next, we present an analysis of our findings, illustrating the opportunities, tensions, and trajectories that appeared when we examined 1:1 implementation alongside the characteristics of effective middle level schools. Finally, we explore the implications of these findings for middle level educators, school leaders, and other stakeholders as they adopt 1:1 programs in schools for young adolescents.

Theoretical and Research Perspectives

Technology Integration

The use of technology in schools has both strong support and considerable opposition. One of the great challenges with research on 1:1 programs in particular is that 1:1 computing, by definition, signifies the level at which access to technology is available to students. It declares nothing about actual educational practices. One-to-one programs are, therefore, problematic to study and compare, as they describe the ratio of technology access, not necessarily how that technology is being used to promote learning.

Because of this challenge, the research on 1:1 programs is understandably polarized. In some cases, strong evidence of improved student outcomes exists. For example, researchers have claimed that student engagement has increased "dramatically in response to the enhanced educational access and opportunities afforded by 1:1 computing" (Bebell & Kay, 2010, p. 3). In one of the earliest and largest 1:1 initiatives, middle level students in Maine demonstrated increased engagement and reduced behavior referrals (Muir, Knezek, & Christensen, 2004) as well as a 7.7% increase in attendance during the first year of the program (Lemke & Martin, 2003). Other studies similarly have documented improved attendance (Lane, 2003; Texas Center for Educational Research, 2009), increased engagement (Bebell & Kay, 2010) and decreased disciplinary problems (Bebell, 2005). Researchers have also observed relationships between technology use in schools and improvements in students' attitudes toward learning, self-efficacy, behavior, and technology proficiency (Hsieh, Cho, Liu, & Schallert, 2008; Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011; Storz & Hoffman, 2013).

Researchers have suggested that a link exists between 1:1 programs and student achievement, specifically that students in 1:1 programs earn significantly higher test scores and grades for writing, English language arts, mathematics, and overall grade point averages compared to students in non-1:1 programs (Lemke & Fadel, 2006). Many others have noted similar positive findings (Campuzano, Dynarski, Agodini, & Rall, 2009; Eden, Shamir, & Fershtman, 2011; Shapley et al., 2011; Suhr, Hernandez, Grimes, & Warschauer, 2010; Weston & Bain, 2010).

Yet efforts to link 1:1 computing with positive student outcomes are inconsistent and complex (Storz & Hoffman, 2013). Hur and Oh's (2012) research indicated greater student engagement, but

no significant difference in test scores, between students who had been given laptops and those who had not. Moreover, as the novelty wore off, student engagement decreased and inappropriate use of laptops increased. Donovan, Green, and Hartley (2010) found that increased access to laptops did not always equate to increased student engagement and, at times, led to an accompanying range of off-task behaviors. Still others have identified few or neutral effects of 1:1 programs (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010; Weston & Bain, 2010). Even when promising interventions are designed and implemented, the integrity of implementation, not surprisingly, seems to strongly affect the ultimate impact. Further, Johnson and Maddux (2006) argued that implementation is only one of many conditions that must be satisfied for technology integration.

Middle School Concept

The middle grades are increasingly viewed as a crucial time for identifying and intervening with potential dropouts, reinforcing the idea that school experiences during early adolescence greatly influence later life outcomes (Balfanz et al., 2014; Balfanz, Herzog, & Mac Iver, 2007). For decades, AMLE has underscored the centrality of this developmental stage for middle level school programs and has called for them to be developmentally responsive, challenging, empowering, and equitable (NMSA, 1982; 1995; 2003; 2010). According to AMLE, effective middle level schools exhibit three categories of characteristics that, together, constitute the middle school concept: (1) relevant and integrative curricula taught and assessed in varied ways (Curriculum, Instruction, and Assessment); (2) schools that are organized to foster healthy relationships across stakeholder groups and are led by courageous and collaborative leaders (Leadership and Organization); and (3) school cultures that are safe, supportive and inclusive, in which all students' personal and social needs are addressed by caring adults specifically prepared to work with the age group (Culture and Community) (NMSA, 2010).

Although relatively sparse, existing research on schools employing the middle school concept has found promising results related to academic and affective student outcomes (Felner et al., 1997; Mertens & Anfara, 2006). Students in schools demonstrating fidelity to the middle school concept, for example, were found to academically outperform and exhibit fewer behavior problems than their peers in schools not implementing the middle school concept (Felner et al., 1997). Lee and Smith (1993) also found certain aspects of the middle school concept to be positively associated with students' academic achievement and engagement, and the Center for Prevention Research and Development's research suggested that implementing the middle school concept could positively impact student achievement (Mertens & Flowers, 2006; Mertens, Flowers, & Mulhall, 2002).

The majority of research on the middle school concept has focused on individual aspects of the concept, such as advisory (e.g., Niska, 2013), principal leadership (e.g., Gale & Bishop, 2014), teacher dispositions (e.g., Thornton, 2013), and common planning time (e.g., Cook & Faulkner, 2010), rather than on holistic implementation of the concept. Mertens and Anfara (2006) argued:

> In order to answer questions related to the middle school concept and its effects on student achievement and socio-emotional development, middle grades practitioners, researchers, and policymakers must move beyond this focus on individual components and look at research that addresses the reform as an integrated model.

To that end, we chose a holistic approach, using the three general categories of the middle school concept delineated in *This We Believe* (i.e., Curriculum, Instruction, and Assessment; Leadership and Organization; and Culture and Community) (NMSA, 2010) as lenses to understand relationships between 1:1 implementation and the middle school concept.

Methodology

This study was conducted over the course of four years and used a qualitative, instrumental case study design (Stake, 1995). We relied on participant observation, teacher and student interviews, meeting transcripts, and samples of student work to explore what happens when a team that enacts the middle school concept tackles the challenge of integrating 1:1 into teaching and learning.

Site and Participants

The site for this research was one team in a middle school serving a town of roughly 10,000 residents in the state of Vermont. Compared to other schools in the same county, the school scored at or near the bottom in reading, writing, and math on statewide standardized tests, even accounting for the 20% of students who receive free and reduced lunch. The town also consistently ranked near the bottom for average teacher salary and per pupil expenditures.

The research took place over the course of four years and focused on a two-teacher or "partner" team called "Engagers" (all names are pseudonyms) serving approximately 50 seventh and eighth graders each year. The teachers brought to their classrooms a deep understanding of the middle school concept. Both were licensed specifically for middle grades teaching; both earned these licenses through a teacher preparation program built on AMLE program standards that was nationally accredited for middle grades teaching. One teacher had seven years of experience prior to the study. She was licensed to teach English language arts and social studies in the middle grades. The other was a new teacher who was licensed to teach middle grades mathematics and science and whose first year of teaching was the first year in the study. A special educator with six years of experience was added to the team midway through the study, and his addition brought the total number of educators on this team to three.

As a result of a university/private foundation partnership, this team received extensive technology resources and professional development to infuse its practice with 21st century tools. In contrast to other teams in the school, each student and teacher on the Engagers received laptops for 1:1 wireless computing. The team space was outfitted with media production technology, presentation equipment, and a wide variety of software. A Web portal served as the program's Web presence and as a central location for curriculum resources. The team teachers were chosen because of their commitment to using technology within an integrative curriculum that emphasized individualization, choice, and project-based learning. The teachers were free to pursue any learning objectives consistent with these commitments and their appreciation for the needs and capacities of young adolescents. There were no explicit standards or objectives added to those already in place across the school. One of the team teachers described the purpose of the project: "I guess I feel like it's adding the 21st century learner to what is already good middle school, middle level practice."

The teachers participated in long term, embedded professional development focused on integrating technology in meaningful ways. A coach provided by the university offered modeling, support, and mentoring twice weekly through the first two years of implementation. The coach came to the project with 10 years of experience providing professional development focused on the middle school concept and on the integration of technology across the curriculum and in classrooms with ready access to personal computers and mobile technologies.

Data Collection

The university coach acted as an embedded researcher who engaged in participant observation, recording field notes twice weekly during the first two years of the program and twice monthly for the latter two years. Teachers and students participated in formal interviews and focus groups twice per year for these four years, averaging approximately one hour per session. Further, informal interviews, reviews of school and district documents, and examinations of digital data were ongoing throughout the four years. Digital data played a particularly important role as much of the students' work was in this form, including photo stories, digital movies, blogs, podcasts, and the team's Web portal.

Data Analysis

We used NVivo, a qualitative data analysis software package, to analyze the digital data, interview and focus group transcriptions, and field notes. This tool enabled rich analysis of the large volume of data generated over four years. We used NVivo to conduct open and axial coding (Strauss & Corbin, 1998) and to identify codes and categories across the multiple data sets to classify emerging patterns. We then created an indexing system to identify themes within and across data sets (Patton, 2002). We aligned the pertinent findings with three categories of characteristics associated with effective middle level schools (NMSA, 2010). Finally, we examined the themes for trustworthiness in light of related literature, triangulation across data types, and member-checking through subsequent interviews and consultations with participants and colleagues (Lincoln & Guba, 1985).

Limitations

This study has several limitations. A qualitative methodology was appropriate for the descriptive and analytical purposes of this research, but the findings should not be generalized to other populations or settings. For example, the study occurred in a rural location with a predominantly White population. Because the sample reflected a relatively low level of racial/ethnic diversity, one might anticipate different themes and issues arising from urban or diverse settings. Further, the presence and participation of the researchers at the site may have affected participants' actions and responses. The rapport researchers developed with participants over the course of four years may have helped alleviate some of this effect, yet

it may also have introduced other complicating factors. We attempted to minimize potential bias through the ongoing use of triangulation and member-checking.

Findings

We discuss our findings in three sections aligned with the categories of characteristics of effective middle level schools in *This We Believe* (NMSA, 2010): (1) Culture and Community Characteristics; (2) Curriculum, Instruction, and Assessment Characteristics; and (3) Leadership and Organizational Characteristics. Rather than provide an exhaustive review of how each *This We Believe* characteristic intersects with the implementation of the 1:1 initiative, we highlight the intersections we believe have the greatest potential to inform efforts to integrate technology in the best interest of young adolescents.

Culture and Community Characteristics

Efforts of Engagers teachers to implement team development strategies varied considerably and met with mixed results during the four years of the study. When the teachers viewed team development as a high priority and a prerequisite to student learning, both teachers and students reported a more welcoming and inclusive classroom climate and greater satisfaction and success with teaching and learning. However, team development was not always a high priority. Throughout the study, technology played a critical role in shaping team culture and community but did not, in itself, compensate for a lack of attention to intentional team building and development.

Years 1–3 and the struggle for team culture. In interviews and planning meetings, the teachers regularly discussed their common belief in the importance of team building as central to effective teaming, teaching, and student learning. However, during the first two years of the study, the teachers did not implement a comprehensive team-building program. Minimal attention was given to team-building tasks or to the collaborative development of norms. Symptoms of a poor team climate were particularly evident in Year 2. According to observation notes from a planning day halfway into that school year, for instance, teachers described turning to the building principal to intervene in serious social conflicts, particularly among girls on the team. In addition, the teachers enlisted the help of an outside consultant to meet with the girls and design opportunities for them to work and play effectively together. In a planning meeting three months later, the team was still wishing for a better support system from beyond the team, including from the building principal, psychologist and behavior interventionist, and special educator. At that meeting, teachers were already voicing concerns about the impact of current students on incoming students in the next school year. In a focus group with eighth graders a month later, students appeared to share their teachers' perceptions of the climate, referring to pervasive "slacking off," routine off-task computer use, and group project work described by one student as "a living hell." With only six weeks left in the school year, the lead teacher conceded, "Things are calmer lately."

As the teachers anticipated, Year 3 team building suffered from the effects of returning students carrying the weak culture from the previous year. As one teacher observed, "Seventh graders coming into a new environment, watching some of the eighth graders, got into some bad habits that way." Although teachers designed an appropriate team-building agenda, including technology-rich projects, such as *Portrait of a Teen* podcasts, and *My Home Town* videos, the team building process was implemented slowly due to conflicting demands on teachers' time and attention. One Engagers teacher described the dilemma he perceived in Year 3:

> The beginning of the year seems like it's kind of a balance because … you want to do team building [but] we have the [NCLB-mandated standardized testing in October] and it's … really kind of hard to get in a rhythm in terms of actually doing, producing work.

The conflicting demands of testing and team building led teachers to delay critical team-building activities, such as a field trip to a ropes course, until after the testing. However, by the time teachers were able to implement the team-building field trip, they observed "some disrespect toward adults. There was just kind of a lack of high expectations in terms of work production, standards of work." By mid-December, after the field trip and the culmination of the podcast and video projects, teachers reported that they finally were seeing a more positive climate develop. "Looking at the seventh graders and kind of where they've come," one teacher noted, "I see some strong interests, adding to the culture of the team, adding to that kind of culture of a work ethic and higher expectations. … I'd say there's more kind of this collective sense of belonging."

We observed a clear intersection between the implementation of technology and the team climate. Marked by behavior problems and a lack of trust

between teachers and students, the poor climate in Year 3 undermined teachers' confidence that they could implement technology-rich projects, particularly those that might emphasize independent or community-based learning. In turn, students expressed disappointment that projects weren't more purposeful and meaningful, as in this exchange among eighth graders in Year 3:

> Student 1: Me and [my friend] really wanted to do like an Audacity [audio software] project about a place that we chose but [the teacher said] we have to choose a place in the school, but we wanted to do outside the school because her grandfather and my dad works at [a hardware store in town].
>
> Student 2: We were supposed to do something outside of school but we never did.
>
> Student 3: My mom keeps driving me crazy about that; it's like, when are you going out in the community?
>
> Student 2: And they said clearly that we were.
>
> Student 4: They said a lot of stuff and it never really works out.

In short, neglecting key culture and community characteristics nominally embraced by the teachers triggered a downward spiral that undermined the team's efforts: teachers didn't emphasize team development; team climate suffered accordingly; frustrated with student behavior, teachers backed away from intensive, student-directed technology projects; and students felt betrayed that teachers' promises of engaging, technology-rich learning were not fulfilled.

Year 4 and a renewed commitment. In contrast to the previous years, in Year 4 Engagers teachers planned and implemented intensive team building at the start of the school year. One teacher described the process of

> just the taking first three weeks … we didn't initiate any true academics. We did a lot of academic type things but taking the first three weeks, going to [a nearby summer camp] for overnight was the absolute key, I think, to starting the year off really, really, really well. Being able to have meals together not in the school building. Outdoors, playing. It was gorgeous weather. And it was just—it just let everybody's shoulders down at the beginning of the year, especially. … They weren't trusting at first—some were, but not all. But that trip was the key.

During the fourth year, technology strongly supported the community building efforts. Instead of withholding technology due to a difficult climate, as in earlier years, teachers integrated it as a way to establish the team culture. Students generated personal timelines using xTimeline (xtimeline.com); explored digital photography and Voicethread (voicethread.com) to identify an image to represent the team; created personal speaking avatars using Voki (voki.com); and chose from Prezi (prezi.com), PowerPoint, or Moviemaker to create presentations about what they wanted to be when they grow up.

The impact of the teachers' efforts, including a winter outing to a ski area, lasted throughout the year. As one teacher indicated in an April interview,

> Just the effort at community building and whatnot, it lends itself to strong relationships between students. And I've heard students just kind of hanging out together with each other and saying, "This is the best team; this is us, I love this team. I love hanging out with you guys."

The team's identity as a high-tech team was further bolstered by the use of Evernote (evernote.com) for personal note taking, Google Docs for collaborative file sharing, and a Google Domain that included student e-mail accounts and collaboratively constructed web pages. This package of tools provided a communication and workflow system among students and teachers that was almost entirely electronic. This was widely described as having transformed the organizational lives of students, to their great relief. It also provided a team culture based on common language, communication patterns, and processes.

The teachers suggested that these efforts early in the year contributed to an almost complete cultural turnaround from the tumult of previous years. As one teacher said,

> Taking the first three weeks and having big … character-building, identity-building projects really helped. … I mean, just from seeing how the students felt about themselves and the team from the start of things 'til now. … There's some people that are just extremely proud of what they do.

Using technology in team building appeared to hold substantial benefits for students, particularly those who had trouble engaging with their peers. Technology introduced a new dimension of relevance that made a difference in the schooling experience of otherwise disengaged students. For example, while

discussing one of these disengaged students, an Engagers teacher shared the following:

> [The student's guardian] just said as far as socially and emotionally this year, he has completely come up. He's still very shy. He's still not one to take social risks but she said his social development has just been exponential. I think [the explanation is] two pronged. I think, one, he loves technology. He's so into what he's doing. He's had opportunities to contribute, not so much … on an academic level, but beyond, been able to make contributions to the team, whether it's updating the website or having a little bit higher purpose. But the other thing is that I think it's been socially responsive for him. He feels safer with the students that he's around and the teachers.

In this case, technology motivated a reluctant student to participate in school and offered him an outlet through which he could shine.

Team-building activities infused with technology also helped convey the team's democratic educational philosophy:

> We started with [digital] photography and Voicethread [for] team building, identifying an image that represents the team. We voted on it and talked about being democratic and that kind of set the stage for how this team was going to work—nothing happens without your say, nothing works without your input—and we meant it. And it was nice to have that real, authentic, human-to-human, not teacher-to-student, but just like hey, we have an organization to run here and the three of us [teachers] aren't going to run it. We're all going to run it together if it's going to work.

In this study, we observed frequent interplay between effective team building and thoughtful technology integration. Members of the Engagers spoke of how these high-tech projects immediately engaged students, helped team members know each other and learn to work together, and shaped their overall identity as a high-tech team. Team building activities contributed to a more positive team climate and led to more ambitious use of technology. The decision to begin the school year with an intensive agenda of technology and team-building activities was particularly beneficial to the team and its students.

Curriculum, Instruction, and Assessment

According to *This We Believe*, effective middle level schools exhibit certain characteristics related to curriculum, instruction, and assessment (NMSA, 2010). We observed numerous intersections between these characteristics and 1:1 implementation with the Engagers team. From the time the Engagers team was formed, the curriculum was designed to be technologically ambitious. During individual interviews and focus groups, students consistently identified technology-rich projects as their favorite learning activities. Their preferences ranged across all projects rather than with one particular project, and nearly all students believed they learned more through the technology-rich work.

Students consistently emphasized how technology marked their team as unique. "A lot of our projects aren't really like a lot of other teams," said one student. "Like we use a lot of technology during the year. It's like I can only think of one or two projects where we didn't use technology." In Year 4, students used more—and more varied—technology than ever. Students were given more flexibility in choosing technologies to use for each project. Some students openly admitted that they sometimes chose a particular approach—creating a PowerPoint, for instance—because it was easier and faster than creating a Prezi or video. Yet, they were quick to acknowledge that the latter are more rich and interesting; and when they were motivated by the topic and had adequate time in their work schedules, they enjoyed more complicated technologies.

Table 1 depicts examples of technology the Engagers team used during the four years of this study. The use of technology within the curriculum connected with the middle school concept in four key ways: authentic assessment, opportunities for individualization, substantial engagement, and a sense of purposeful learning and meaningful student involvement.

Authentic assessment. The surrounding town played an important role as an authentic audience for the team's work, and technology was particularly well suited to sharing student work with audiences beyond the school. Senior citizens and other guests assembled in the town's historical society, for example, to watch and listen to students' Photo Stories and videos about town life in the years of depression and war during the 20th century. The team also hosted an evening at a local coffee house to share with the community podcasts students developed for inquiries into issues of personal concern to them, such as bullying, stereotypes applied to their town, and safety in online social networks. Parents, neighbors, schoolmates, administrators, other teachers, and a reporter for the town newspaper were among the guests.

Table 1
Examples of Technology Use on the Engagers Team

Year One

Our Town digital stories and videos

Our Town in the 1930s and 1940s community interviews, digital stories, and videos

Teens' Questions podcast

Current events, team life, and writing blogs

Year Two

Who Am I? photo stories

Native American Myths claymation videos

Mathematics Concepts claymation videos

Stereotype public service announcement podcasts/ photo stories

Science concept web pages

Year Three

Topical PowerPoints

My Home Town interviews, videos, and photo stories

Presidential Candidate public service announcement videos/photo stories

Portrait of a Teen interviews and podcasts

Science concept claymations

Year Four

Personal Timelines using xTimeline or Prezi

Create a team image with digital photography and Voicethread

Create personal speaking avatars with Voki

What I Want to Be When I Grow Up with Prezi, PowerPoint or Moviemaker

Personal note taking with Evernote

Collaborative writing, daily file sharing, surveys, and quizzes with Google Docs

Collaboratively constructed topical web pages with Google Sites

Student e-mail and electronic student-teacher communication with Google Domain

Functions of a Cell claymations

Diseases public service announcements using FlipCams and Moviemaker

People of the Revolutionary War using xTimeline

Species web pages using Google Sites

Students and teachers alike noted the impact of these audiences on engagement and effort. Contrasting the experience of working only for their teacher with working for an authentic audience, an eighth grader offered his teacher a sentiment shared by many of his peers, "If we were to just give [our writing] to you, obviously it seems like it's worthwhile, but when we actually put it out to the community, it's kind of like it's going somewhere, there's an actual point to it."

Teachers observed that technology provided students with a means of sharing their work that was new and that few in the audience would have mastered, and the products students created impressed adults and peers beyond their team. One teacher described the students' experience with community audiences as purposeful, prideful, and motivating:

> When they had to stand in front of the people at the historical society and people told them that they were impressed, I think that impacts them. I think they push themselves to create something that they care about. I just see a big difference when they have someone to show their work to… the pride associated with that.

Rather than being daunted by the challenge of public presentations, students spoke quite directly to a convergence of authentic assessment, technology, challenge, relevance, and efficacy evident in projects that incorporated these elements. When asked why these projects help with learning, one student noted,

> With the podcast, we have to show people what we were doing and what students think, which was pretty fun. That's what I like is that we get the chance to share it. Usually in class, you know, you do a project and you throw it in the trash the next day because you're just there to get the grade and then be done with it.

Individualization. The teachers noted that technology-rich projects allowed them to individualize learning opportunities for the wide range of students in their classrooms. One teacher said,

> The Podcasting project really lent itself to individualizing almost on its own. The kids that needed more time to work on the writing or to work on the broadcasting piece of it had the time to do it, while other kids were going beyond that and incorporating visual slideshows. They really worked to their own ability and I felt like that was a good example of something being individualized.

The teachers continued to note the advantages of matching specific technologies to the unique needs of some students. Particular technologies resonated strongly with some students, a phenomenon that especially caught teachers' attention when it involved otherwise disengaged students.

> Claymation can be so engaging for some. They could work on it for 3 hours straight. For some—the kind of artistic piece, the creation, trying to come up with this overall vision can be tough and kind of daunting and they end up making Play Doh snakes all class. But Andy, for example, he just basically asks me every week, "Are we going to do Claymation soon? Are we going to do Claymation soon?"

Relevant and engaging curriculum. Students regularly noted the significance of technology in contributing to more diversified and engaging learning. One student explained,

> Yeah, this year has been fun for me because we do a lot of projects as a group and as a team and have a lot of fun in the process. Like, we made claymations [portraying Native American stories and myths] in the beginning of the year and it was fun because I was with a lot of my friends and we have a lot of fun making the figures and shooting it.

When asked about which projects she found particularly engaging, another student offered,

> The Home Town [project] because something I feel very strongly about is being connected to your hometown and being able to make that podcast and have people see it. Maybe it changed people's opinion about [the town]. Because every picture I took was people smiling. Not like gangsters from [our town] that people think are here, [which] so aggravates me.

Yet another student described the use of technology on the team in this way:

> If you have like a short attention span or something and you really don't like sitting and listening to somebody talk; if you learn better actually doing something, you will have a better idea of what it is because you're actually like doing it yourself, you know? Like the whole podcasting thing that we did? I mean a trip to [the local public radio station] and actually creating the podcast itself and when you got to research your own topic. That made it more interesting for me doing whatever it was.

Students on the Engagers Team learned from these technology-rich projects and appeared encouraged by them. As one teacher noted, "I think day-to-day they're getting some real life skills that maybe in more traditional classrooms they don't get." She was impressed by the range of students engaged by technology, such as in the podcasting project. "Half of me is looking at the kids who are flying and half of me is looking at the kids who need more support. Both are doing more than I think they would in a traditional classroom."

The teachers appeared to appreciate the role technology played in the success of the program generally and in project-based learning in particular. The adults were of one mind that technology "hooks the kids;" "gives students another avenue to demonstrate learning;" and, with opportunities such as podcasts and digital movies, "touches on people's artistic sides, engaging the mind and teaching students." As one teacher surmised,

> What we saw is, if we gave students a choice in their learning and assisted them with some pretty high tech technology, that would help them buy into the system, take ownership of their own learning, and make it their own and sort of change their ways.

Purposeful learning and student involvement. Engagers teachers noted the role of purposeful learning in students' engagement and success. One teacher observed, "I definitely saw a difference between producing work for just the teacher or for classmates, but then having something open to the community. I think it ups the ante even further; it has … real purpose beyond just that event." Another agreed,

> We're not just completing projects and then moving on to the next thing. The desire is that everybody has a role and purpose and is excited to come in so they can fulfill that role and that purpose. It's trying… to build self-esteem by purpose.

The teachers saw technology as opening avenues for purposeful learning and, while only in its nascent stages of development, they imagined examples that appeared feasible and sustainable.

> But one of the things that we've been thinking about …was the idea of students having a role not only in the classroom, but … (creating) some

> sort of content site that is somehow informing (others)… turning and sharing and expressing artistic ideas, sharing research, sharing insights into different types of math concepts or whatnot.

Student involvement appeared to be central to the teachers' emerging plan. One teacher wondered, "I think student involvement is huge. So we think we have this great idea. How do we get students to not only buy into it but also kind of co-create it?"

In spite of the challenges associated with integrating technology, the teachers expressed confidence that their students could embrace the technical challenges that may lie ahead.

> We have certain capabilities that other teams might not have, I think. Just being—having the technology, being around it every day. I think students don't have an idea how technologically savvy they are compared to other students, compared to other teachers in the school. … I've heard anecdotes about students going (to high school) and basically teaching the rest of their classes how to do stuff.

The Engagers teachers also spoke of untapped pedagogical opportunities worth exploring, such as students' out-of-school technology use.

> I have a student that did his project … in Google Sketchup, 3D. So he did it all at home. And I said, this is great. And he said, yeah, I use it all the time at home. … And hearing that he uses it all the time at home starts me thinking, why? … Why is he much more inclined to be motivated to do something at home on his own free [time]? … Are we really giving students the opportunity to do something purposeful and contribute?

As he posed this question, "What's he doing with it at home that he's not doing here?", this teacher pondered what he, and the team as a whole, might learn from students' out-of-school technology use that could inform in-school technology use. As one Engagers teacher observed,

> I just think there's so much power in the technology … But it's kind of being fitted to … the usual framework of school. …How do we go beyond that? …I want students to be motivated to use technology in a way that's going to contribute.

The teachers saw this "usual framework," that of established standards and curriculum, as impeding their ability to fully exploit the power of technology. When asked what they require in order to achieve their vision for meaningful, high-tech learning, one teacher said,

> [I need] some sort of liberation… There's always this voice in the back of my head that says, "You've got to do CMP [Connected Math Program]. You've got to – there's these standards, there's these standards, there's these standards. This is the district curriculum." So making the decision: … Is our curriculum driving our product rather than our product driving our curriculum? Best practice, backward design, would say let the product drive the curriculum, but the State [tests] and other folks would say let the curriculum drive the product.

This quandary is somewhat familiar to teachers trying to create more responsive middle grades classrooms, but the potential of student technology use seemed to exacerbate the conflict between established curriculum, standards, and the promising innovations these educators and their students wanted to pursue. Indeed, for students as well, exposure to the engaging, creative, and self-directed potential of technology-rich learning placed more traditional pedagogy in stark relief. The special educator associated with the Engagers shared potent observations about the interactions among pedagogy, technology, and one particular student as he wondered what it was like for students to be in a technology rich environment and then move into classes that were not.

> As a kid it's got to suck that one minute you're really excited and you're fired up and you're, "Oh, cool, we're going to be working with Google Sketch Up and I get to finish my photo story," to [a different class where] "I'm on Google searching images." You know?

The Engagers infused technology into the curriculum, instruction, and assessment, and in many ways their approach reflected the type of pedagogy espoused by many middle grades advocates and *This We Believe* (NMSA, 2010): individualized and engaging work for a genuine purpose and audience.

Leadership and Organizational Characteristics

The Engagers team reflected some of the organizational characteristics of effective middle grades schooling (NMSA, 2010), but it fell short of others. For the purposes of core academics, the teachers functioned as a partner team. The special educator assigned to the Engagers was dedicated

to the team, occupied a desk in one of the team's adjoining classrooms, and was therefore intimately connected with the students and their primary teachers. However, inadequate common planning time and poorly coordinated professional development hampered the team's progress.

Common planning time. One oft-cited cornerstone of the middle school concept is interdisciplinary team organization supported by collaborative time for planning (NMSA, 2010). When asked how they would design a team like Engagers based on what they've learned over four years, one teacher noted—and his colleague agreed—

> One of the places where we fall short, and it seems to be the story of our lives … is just kind of uninterrupted time … where we can collaborate as professionals…. Common planning time … it's just been very tough to do.

In addition to 45 minutes of personal prep time each day, the team had one hour and 40 minutes (including lunch time) every Wednesday afternoon for common planning. Also, Friday afternoons were available once each month for common planning time. Because administrators eliminated daily common planning time just prior to the beginning of the Engagers program, the team fell well short of the quantity and quality of planning time associated with many of the documented benefits of this key organizational structure: interdisciplinary practices, increased teacher satisfaction, and improved student learning (Mertens, Flowers, Anfara, & Caskey, 2010). Limited common planning time can undermine collaborative professional growth and coherent pedagogy across the team (Haverback & Mee, 2013), and these are critical elements for serving individual students, particularly those who are disengaged. Further, teachers noted frustration about how they used their common planning time. In Year 3, one teacher described the Wednesday meetings as "mostly focused on students" and "nagging issues." The Friday meetings were described as "like an extra team meeting. We don't ever get to planning. It's like the planning gets pushed off. … I think we all just stressed over the fact that time goes by and we still haven't had a chance to really talk about coming together in a project."

This study illustrates that the need for collaboration may be acute with the rapid infusion of technology. The Engagers teachers faced steep learning curves as they grappled with a wide array of technologies and integrated technology into the curriculum and daily life of the team. Further, as they transformed their work, their practice was ripe for reflection and inquiry. In an ideal setting, effective daily common planning time creates opportunities to examine student work collaboratively, as well as discuss the successes and failures of day-to-day teaching.

Professional development and a shared vision. Engagers teachers were also concerned about feeling isolated from colleagues within and beyond their school as they worked to implement 1:1. They expressed a desire to "talk to professionals or people who have done similar things," or to be part of a teacher network. Instead, the Engagers teachers' extensive collaboration with their peers was poorly aligned with the needs of their team. For instance, Engagers teachers were expected to participate on district curriculum committees tasked with producing new, vertically aligned, separate-subject curricula and common assessments. As dual-endorsed teachers well respected by their colleagues, each Engagers teacher was asked by their principal to serve on two of these subject-area committees that met for a full day once per month, in part so they might infuse committee discussions with innovative thinking. However, the priorities of the district committees contrasted with the Engagers' efforts to create a responsive curriculum for a team uniquely outfitted with 1:1 laptops, electronic whiteboards, sets of still and video cameras, digital voice recorders, and multimedia production software and hardware. "The whole idea [of the committees] is common assessment and everything aligning," an Engager teacher explained. "That seems to be everyone's focus and to not be focusing on that seems like we're not in line with where the district's going. It doesn't look the same."

Moreover, the committee meetings replaced opportunities for whole-day planning to address their team's more relevant and immediate concerns. As one teacher pointed out, "I think the real stress is that we don't have time to do integrated planning as a team. I'm already out twice a month for [district] curriculum meetings. It doesn't really help our classroom environment to not be in the classroom." The district's priorities to comply with state standards, to vertically align the curriculum across grades K–12, and to involve teachers democratically in the work—all indicative of responsible leadership—nonetheless ended up at cross-purposes with the innovative 1:1 agenda of the Engagers team. Because they were working to develop curricula to address the needs of their generally low-tech district, the energies of the Engagers teachers were diverted away from

developing curricula to meet the needs of uniquely situated Engagers students.

Overall, school leaders in this case did not recognize adequately the substantial need Engagers teachers had for common planning time, nor did they acknowledge the professional development challenges Engagers teachers faced as they learned about and managed the technology, invented pedagogically powerful methods for its use, and re-created curriculum and team life—sometimes from scratch—to unleash newfound technological and pedagogical potential.

Conclusion and Implications

Our examination of myriad intersections between 1:1 implementation and the characteristics of effective middle schools over the four years of the Engagers team yielded a number of lessons worth considering as educators search for ways to work with young adolescents in technology-intensive settings. Teachers and students made it clear that ready access to educational technology is a vital force for engagement, relevant to students' lives, and inspiring for their teachers. Their efforts exposed important vulnerabilities of a team embarked on creating computing-intensive learning opportunities for young adolescents. But their work also offered convincing evidence that 1:1 technology can be thoughtfully integrated into fundamentals of responsive middle grades practice, such as cultivating a responsive team culture, designing relevant and engaging curriculum, and attending to well established principles of effective leadership and school organization.

Culture and Community Characteristics

One-to-one technology played a central role in successful team building activities. When team building was a primary focus during the first weeks of school, both teachers and students reported a more welcoming and inclusive classroom climate. Technology offered teachers innovative and engaging ways for students to explore group and individual identity, come to know each other, and learn to work together. Moreover, technology offered relevant and accessible avenues for otherwise marginalized students to find their voices and places on the team. Further, students embraced a group identity as a high-tech team.

The ways in which we observed aspects of team culture intersecting with 1:1 implementation yield important lessons for middle grades teams embarking on 1:1 initiatives. Combining innovative technology with extensive team-building activities can create inviting, safe, and inclusive learning environments. Moreover, effective use of 1:1 technology can facilitate engaging learning opportunities that are relevant to students' lives and reflect technology-rich cultures beyond the classroom walls. However, once students come to expect such an environment, retreating from or withholding purposeful and technology-rich pedagogy can seriously undermine engagement and students' trust in their teachers.

Curriculum, Instruction and Assessment Characteristics

Teachers and students in our study made it clear that technology-rich curriculum can be active and purposeful, challenging and relevant, and creative and individualized. Students consistently regarded technology as engaging and beneficial to their learning. They were proud of their technology-infused projects and appreciative of the benefits technology offered their day-to-day work lives. Teachers saw 1:1 technology as an inspiration for and pathway toward an emerging vision of more purposeful and authentic teaching and learning. However, our findings suggest that as teachers tap into students' increasingly pro-technology dispositions, they may find themselves increasingly at odds with established low-tech standards, curriculum, and assessments.

Leadership and Organizational Characteristics

Our examination of 1:1 implementation on the Engagers team highlighted fundamental principles of middle grades school leadership and organization. Teachers identified the lack of adequate common planning time as a critical obstacle to serving students better with technology-rich pedagogy. The need for common planning time was acute as teachers faced steep learning curves associated with specific technologies and, more important, as they designed and implemented a brand new 1:1 team and curriculum. Their challenging and innovative path was ripe for collaborative reflection, but they lacked two critical elements of effective teaming: time to meet daily and the knowledge, discipline, and support to use it well.

The lack of a shared vision for school improvement and professional development exacerbated the inadequacy of teachers' planning time. Although Engagers teachers wanted to network with peers confronting similar challenges, the considerable time they devoted to curriculum work with peers had little to do with their team's trajectory. Collaborating on district curriculum diverted energy away from developing curriculum appropriate for Engagers students.

As leaders initiate 1:1 programs, they need to consider the extraordinary scope and complexity of the undertaking for teachers and students. All other school improvement agendas—improving literacy and numeracy, for instance—may need to be carefully tailored to the specific challenges and opportunities of technology-rich, 21st century teaching and learning so as not to overwhelm teachers and undermine the 1:1 effort altogether. In short, the divide between non-technological pedagogy and 1:1 teaching and learning is mirrored in the starkly contrasting professional development agendas associated with each. When a single team is leading the way with technology integration, as was the case with the Engagers team, leaders may need to structure two distinct reform agendas: one to address the needs of students on the high-tech team, and a separate agenda to address the needs of students on other teams. There may be no other way to honor the professional development needs of teachers practicing on opposite sides of a digital divide within a school.

Another leadership challenge relates to the potential for competition among teams when a 1:1 laptop team works in the same building as non-laptop teams. This situation can challenge the reluctance of some teachers, students, and administrators to allow teams to stand out from one another. Continuous and rapid changes in technology and related pedagogy may inevitably lead to significant differences among teams within a school—even among different 1:1 teams. Leaders may need to discover ways to exploit positive aspects of team diversity rather than resist it.

Leaders face a related tension between responsive, technology-rich learning and established, often standards-based, curriculum. The evolution of technology standards, even in the last decade, is indicative of the lag between emerging learning opportunities on the one hand and standards and official curriculum on the other. The original National Educational Technology Standards (NETS) published by the International Society for Technology in Education (ISTE), for example, needed a complete overhaul before many educators were able to implement them. The standards for students (NETS-S), originally published in 1998, were replaced by completely different—and far fewer—standards by 2007. The NETS for teachers and administrators had similar shelf lives. Assertive and innovative leaders spent much of the first decade of the century basing technology initiatives on the earlier standards which, by mid-decade, were widely regarded as out of date. Standards and written curriculum can either be progressive or conservative forces in school improvement, a paradox particularly problematic given the fast-paced change of technological innovation.

Concluding Thoughts

To fulfill its promise in the middle grades, the implementation of 1:1 computing must be coupled with characteristics of effective middle level schooling—exploiting characteristics already in place and pursuing those that are lacking. Researchers and educators should design studies and interpret findings through the broader milieu of what is educationally effective with and responsive to young adolescents. Attention to "technological pedagogical content knowledge" (Mishra & Koehler, 2006) for teachers should be matched by reinterpreting teaching, teaming, and leadership practices that serve today's young adolescents, fulfilling their need for technologically responsive middle schools.

The intersections we examined between 1:1 implementation and the middle school concept are only a few of many worth exploring. We hope that future research will uncover insights into how such technology programs intersect with teacher advisory or comprehensive guidance programs. For instance, we know a student support team that electronically "pushes" information and strategies to teachers in an effort to promote classroom-based guidance. We have observed how 1:1 programs intersect with varied and ongoing assessments, such as comprehensive portfolio assessment and student-led portfolio conferences. We are also confident that educators can learn much by exploring the intersection of technology integration with ongoing professional development, family involvement, and organizational structures that support meaningful relationships. We suspect that embedded in many of the pedagogical struggles with 1:1 programs are familiar lessons about how to engage middle schoolers in learning. These inquiries may help us forge ahead with technology integration, despite the many challenges, to address the widening gap between the in-school and out-of-school technology lives of young adolescents.

The Engagers teachers are witnessing, along with the rest of us, the rapid infusion of technology into classrooms as more and more schools adopt laptops, netbooks, tablets and other technologies. With their team's greater fluency with high-tech teaching and learning, they noted the new challenges that lie ahead—challenges they wanted to embrace. They also asked important questions of the middle level movement.

I think having access is key. But, at the same time, access is becoming just more and more readily available. And I think that's part of our motivation is that everybody is going to have access to technology. There is great power in not only access to information but being able to produce content and put out information. And so how do we get students to use it in the best possible way? It's kind of pushed us to the next step of, "Okay, so now we've done these kind of cool things; what's next? What's the greater vision and where do we go from here?"

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