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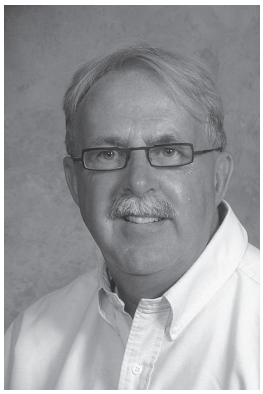
by Tony Donk, Ph.D., Zachary Adams, and Allix Hutchinson



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Mr. Adams, a kindergarten teacher in a small Midwestern city, was meeting with the parents/guardians of his new students prior to the beginning of the school year. One topic that drew everyone's attention was the use of digital technology. The school district had recently passed a bond issue to make every classroom in the district a one-to-one digital environment. Parents/guardians wondered how much "screen time" their young children would receive each day. Some asked if this use of technology would really be beneficial at such an early age or if it might be better to delay digital work until a later time—after their children had learned the "basics." In short, parents/guardians wondered if digital technology was developmentally appropriate. Mr. Adams believed that each of these lines of inquiry were legitimate. He did not have research-based responses for all of them. However, he did believe that technology would provide each student with another tool for both learning and demonstrating their understandings. He assured the parents/guardians that he would work hard to find the most beneficial and appropriate uses of the iPads assigned to his students. Students would all do the same assignments and would be given a choice whenever possible to select their own tools—paper, pencil, scissors or iPads, but probably not rocks! Mr. Adams also invited the parents/guardians to help him in his efforts. He explained that prior to the first day of school, each parent/guardian would receive a survey that would help the study authors to understand each child's level of experience with various types of technology. These could then be used to direct instruction with digital tools for each child.

Mr. Adams is a highly skilled teacher who personally enjoys integrating digital technology into his kindergarten classroom. Prior to this meeting with parents/guardians, he worked with the other authors of this case study—Dr. Donk, a college professor, and

Ms. Hutchison, an undergraduate preservice teacher. Together we worked to deepen our understanding of the Common Core State Standard for kindergarten which states that learners will, "with guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers" (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Although Mr. Adams has students use iPads for many subjects in his classroom, he turned his focus to student writing efforts.

Mr. Adams was part of the initial development of the protocols for this case study in his kindergarten classroom. However, to avoid any potential bias, he was not informed about which students were participating, based on the consent of their parents/guardians. He collected data from all students, but Mr. Adams was not part of any analysis of the data or classroom observation notes until after the five months of the study. His two co-authors explored the research on digital technology and composition for young children, as well as how this might be best implemented in a classroom setting for early learners. They developed a parent survey (Appendix) that was used to determine what students knew and were able to do with digital devices prior to starting school, as well as their access to digital devices in their home environments. They documented instances of teaching and learning in Mr. Adams's classroom and used them to develop teaching tools, including ways to differentiate instruction based on students' prior knowledge. After the study was completed, Mr. Adams rejoined the other authors as they all analyzed the collected data.

In this article, we will use the case of Mr. Adams's kindergarten classroom to show how digital devices (such as an iPad) can be used as tools for composing text in a developmentally appropriate manner with young learners. To achieve this goal, we examined environmental influences on children prior to entering the school setting and how these might impact the attainment of school-based goals and objectives for digital writing in the kindergarten classroom.

Determining the Prior Knowledge of Young Children

Anyone working with young children knows the challenges of determining their background knowledge through a question and answer approach. To gather this information as efficiently and accurately as possible, we used a parent/guardian survey (Appendix), which we sent out digitally to all parents/guardians with students in Mr. Adams's classroom prior to the start of the school year. A survey like this one can help you determine the level of exposure each student has had to digital devices of all types and how this will influence your instruction. In short it can serve as a tool to help you determine what is developmentally appropriate for each of your students. Some children come from technology-infused environments with multiple digital devices and rich opportunities for seeing them modeled by others and/or using the devices themselves. Likewise, a child may have limited exposure due to the costs associated with digital devices or based on parental/guardian choice. Knowing the amount and type of exposure a student has had to digital tools prior to instruction is an essential factor in the teaching and learning cycle (Neumann, 2016). Similarly, it is possible to gauge the attitude of parents and guardians toward the use of developmentally appropriate digital tools in the classroom setting. While many parents may be fully supportive, some carefully crafted questions on the survey can help you to determine which parents/guardians might not be. With this information in hand, you can work with parents/guardians to insure that they understand how and why digital tools will be used in the classroom.

Introducing Digital Tools to Young Children

When introducing a digital device to young children it is important to learn about their personal perceptions of past experiences with technology (McLach & Arrow, 2017), as well as to explain how the new technology will be used (Donk et al., 2018), and give time for exploration. Mr. Adams began his introduction of iPads to his class by simply asking the students to "raise your hand if you have an iPad at home." He wanted to

understand which students have had access to iPads in the past and how that might influence his introduction of the new learning tool. Before handing out the iPads to the students Mr. Adams began talking about how the iPad was going to be used. He referred to the iPad as a *learning tool* and explained that it is a device that would help the class read, write, do math, and communicate with others. His intention was to encourage their perceptions of this digital device as a learning tool, much like the other tools available in the classroom, including paper, pencils, crayons, and rulers. The parent survey results indicated that many students in the class used various types of digital technology to play games and watch movies (Donk et al., 2017). He wanted to make it explicitly clear that the iPads in his classroom were tools for learning, not toys.

Once the iPad was introduced as an instructional tool, Mr. Adams had the class help brainstorm ways to use their new learning device. The class generated an anchor chart that showed how to handle the iPads and what the iPads would be used for in their classroom. The anchor chart that the students in Mr. Adams's class constructed helped to create several ways to use their new iPads (Figure 1).

After discussing and creating the anchor chart the students began to understand that the iPads in the classroom would be used differently than the iPad or other digital devices that they had at home. Like all other tools in his classroom, Mr. Adams wanted students to be clear about the care and use of the iPads. He also wanted to teach them about the routines they would employ with these digital instruments. Mr. Adams projected a student iPad on the classroom smartboard using an Apple TV. He showed the students how they would be able to identify their iPad by showing that each iPad had a number on it that matched the student's number for their seat and mailbox. The number on the iPad also identified where the student would charge the iPad in the charging cart by matching the number to the cord and the iPad slot. After the

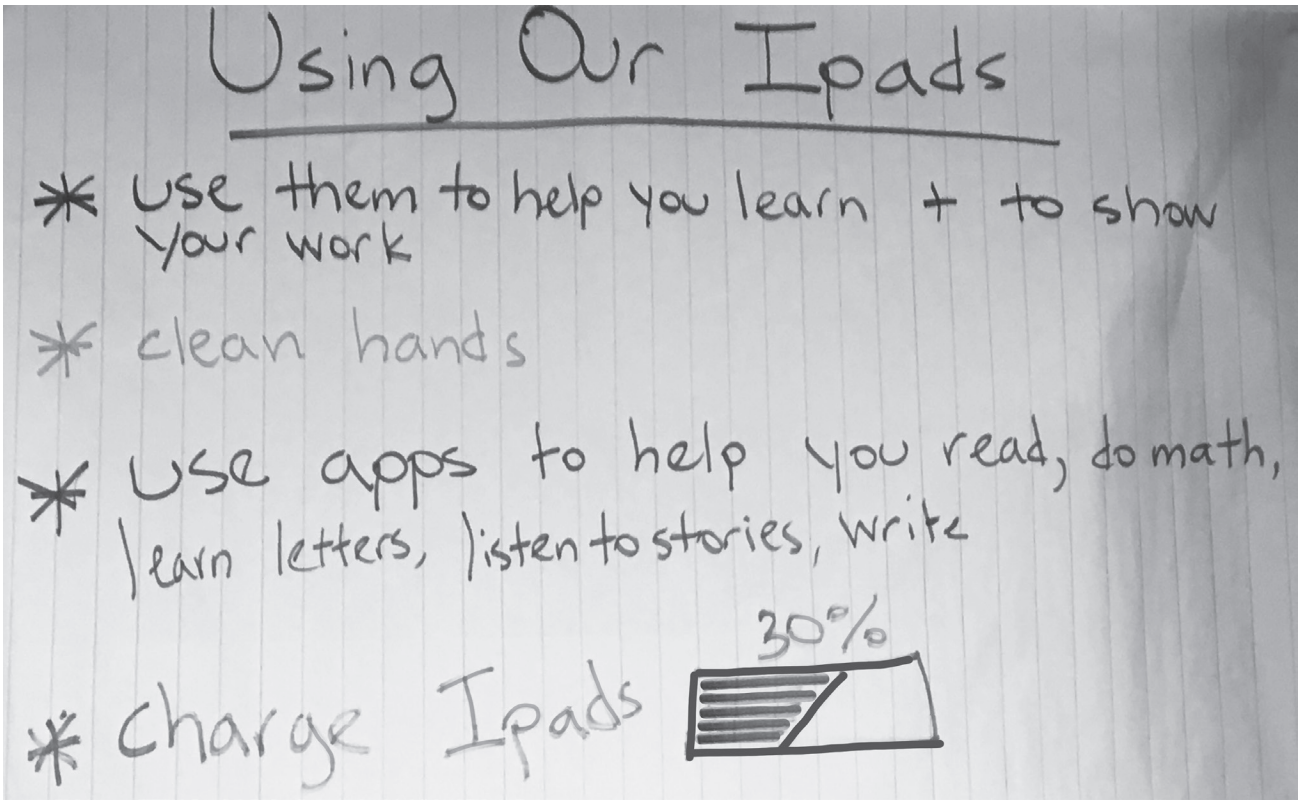

Figure 1. Class iPad anchor chart.

students learned how to identify their own iPads, Mr. Adams talked about the different buttons on the iPad and how they functioned. As the student iPad was still being projected on the smartboard Mr. Adams modeled how to turn the volume up and down and how to make the iPad wake up and go to sleep. He helped the students locate the headphone jack because they would be using headphones when listening to books. They also needed to learn how to record their own voices reading what they had written, which is especially helpful for a teacher when a student's writing is not yet conventional. Rather than dictating to the teacher what they have written, children can record it. When all the different parts of the iPad had been shown and talked about, Mr. Adams showed the students one last part of their iPads. On the back of the iPads there was a blue shape. Mr. Adams showed the students this blue shape because the students would use it to show him that they were listening to him when he was talking. Mr. Adams practiced with the students by saying, "show me the blue" and the students would flip their iPads so he could see the back of their iPad case. Finally Mr. Adams gave the students time to explore their iPads.

During the exploration time on the iPads Mr. Adams showed the students an app that they would be using. He demonstrated how to open the app and find their names. After a few minutes Mr. Adams began to notice that some students still needed assistance using the different iPad buttons and that some were getting frustrated. Quickly, Mr. Adams pulled a small group of students aside to review the different iPad buttons and to walk them through opening the app and finding their name. Students needed explicit introduction with this digital device to ensure that they would be as comfortable as possible with it and as a way to help them become independent in their use of this technology tool for writing. As noted earlier, the parent surveys indicated that many students were experienced with using digital devices to play games or watch programming, but few of these required students to actually compose original text with a keyboard—something that Mr. Adams would be focusing on in writing instruction.

Writing Development

When helping young children make progress in their writing, whether with traditional or digital tools, it is essential for teachers to first determine the stage of writing development for each student (McGee & Richgels, 2012). Young children progress through four main stages of writing development. These four stages are the pre-literate, emergent, transitional, and fluent writing (Moorman, 2010). Because using digital tools for very young learners is still a novel concept for many early childhood educators, it is not uncommon for teachers to hold a belief that children should move through each writing stage using traditional paper and pencil only and before giving them access to digital writing tools. Indeed, while the CCSS call for composing and publishing digitally starting in kindergarten, the empirical research on the use of technology with early learners remains scarce (Neumann, 2018), likely adding to the reticence of some early childhood educators to use digital technology in the classroom setting (Hatzigianni & Kalaitzidis, 2018). Mr. Adams addressed this potential concern by assessing students' writing efforts with both traditional and technology tools and comparing and contrasting results.

During Mr. Adams's writing instruction time he would often give students the option to choose between writing with paper and pencil or using an iPad to compose their writing. Regardless of their choices, Mr. Adams would have students capture their writing samples using the Seesaw app (Sjogreen, 2019) as a way to monitor student growth. Students either took photos of their paper and pencil writing efforts, composed directly on Seesaw, or wrote on another app that worked with Seesaw. Each of these methods allowed students to capture their documentation to Seesaw and it then served as part of an e-portfolio, allowing Mr. Adams to monitor student writing efforts. As the year began, students progressed in their writing development from the preliterate stage, where they were creating mock letters and using images to convey ideas, to the emergent stage where they were creating letter strings or groups of letters along with their images to convey ideas (Figures 2 and 3).

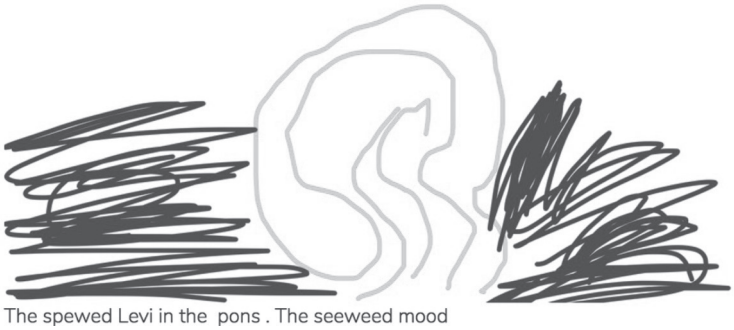

Figure 2. Letter string writing digitally.

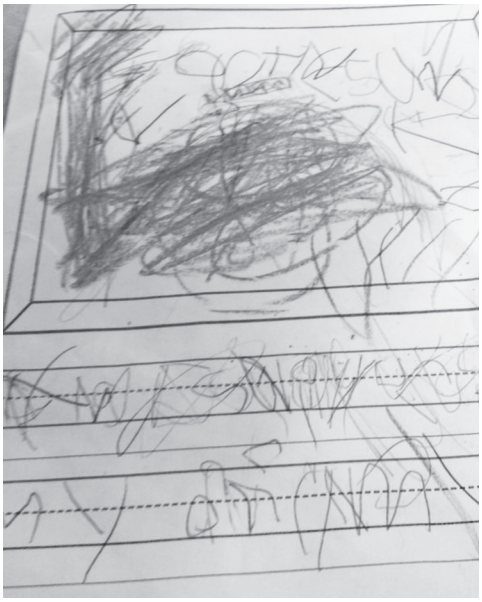

Figure 3. Letter string writing with paper and pencil.

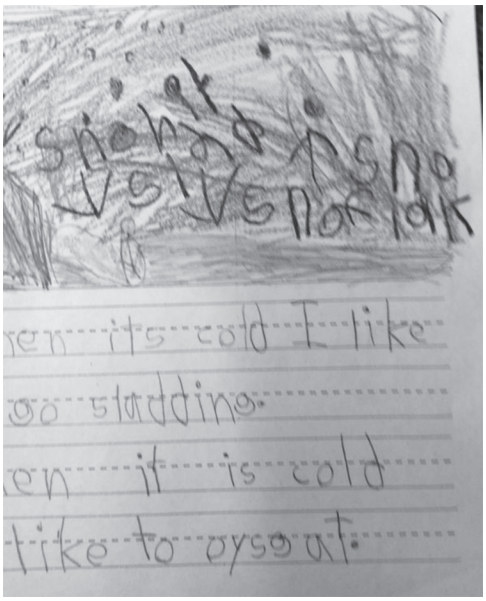

Figure 4. Writing words with paper and pencil.

As the students captured their writing samples using the Seesaw app, Mr. Adams began to notice that his kindergarten students' writing development remained comparable while using paper and pencil, as well as their iPads. If a student was writing in groups of letters that resembled words on paper and pencil (Figure 4), the student would also typically write in groups of letters resembling words on an iPad (Figure 5) (Donk et al., 2017). This similarity in stage of writing development across writing tools was noticed in the work of nearly all students, no matter how often they choose writing with paper and pencil or iPad. Specifically, if a student elected to use each tool 50% of the time, or 80% for one tool and 20% for the other, his/her writing development remained similar across writing platforms (Donk et al., 2018).

Figure 5. Writing words digitally.

Mr. Adams's goal was to teach the skills necessary to move to the next stage in writing development and he did not focus on or require students to use any one specific writing platform as he assessed their writing development. Encouraging students to select the tools that they found most useful in their writing efforts provided them with agency and allowed for developmentally appropriate practice. Allowing the students to make choices in their use of writing tools gave all students opportunities to show their writing development in an authentic manner.

Teacher Tips for Using Technology with Students

Our observations in Mr. Adams's classroom led us to a number of discoveries about practical, yet easily overlooked practices for making technology use more developmentally appropriate for young children. We have reduced these to a number of "tips" that can support your use of both digital and traditional paper/pencil tools during classroom writing time.

Tip #1: Spell Check. It is useful to turn off all auto correct or spell check systems on your students' digital devices. Spell check can tamper with the authenticity of student writing. In Mr. Adams's classroom, students had instances where they became frustrated when they used their current level of phonetic skills to type letters on the digital keyboard, only to have the device highlight their words as being spelled incorrectly. One student remarked, "I get something right but it says I didn't get it right." The auto correct system that highlights misspelled words immediately drew attention to students' attempts to compose words and made some students anxious, as well as diminished a number of students' willingness to use the temporary or invented spellings that Mr. Adams encouraged them to attempt. Simply turning off the auto correct or spell check features eliminated this issue. Students are then able to write using what they know, and you are able to see their actual attempts.

Tip #2: Letter Formation. Take time to explicitly teach the differences in some letter formations between digital fonts and the print manuscript models you are using to your students. For example, the letter "a" looks different on a digital keyboard than when it is handwritten. Also consider this same issue with the letters "g" and "q." These differences in appearance sometimes confuse students who are still relatively new to the letter formations they are being taught versus the fonts that are often used on digital devices. As Mr. Adams was conferring with students during his writing time, he noticed one kindergartner with her head buried in her arms. When Mr. Adams asked the student why she was frustrated, she responded by saying that she couldn't find the letter "a" anywhere on her iPad's keyboard. A brief instructional moment eliminated this issue in the moment. However, by addressing these differences ahead of time, you will relieve some students' frustration when using a digital keyboard and save them time and unnecessary confusion throughout the writing process.

Tip #3: Writing Space. Ensure that students have a relatively equal space for writing or drawing on both paper and a digital device. Students often want to use the writing tool that gives them the most space. By making both writing and drawing spaces the same size, you are leveling the playing field between the two writing tools. For example, when asked why he chose to write on his iPad one day, a student in Mr. Adams's class reasoned, "because there's more room to put words." Another student said that she chose to write using paper and pencil one day because, "you can get more space, and you can color more stuff without it getting on the other color."

Since Mr. Adams's students used iPad minis as their digital devices, Mr. Adams created writing paper that had a picture box that filled about half a piece of paper, making both writing spaces similar in size. Mr. Adams intentionally ensured that students' writing and drawing space was relatively equal for as many tasks as possible so that space was not the sole reason why students chose one tool over the other.

Tip #4: Digital Portfolio. Finding a place or method for storing student writing efforts that is workable

for both their digital writing and their work done on paper can seem challenging, but it is necessary so that you can reference all writing samples efficiently. A typical writing binder or paper folder will not be workable for keeping digital writing samples. Mr. Adams used the Seesaw app for this purpose. This app (and others) allows students to save and organize their work. Students can take pictures of their paper/pencil writing and load these onto a digital portfolio. Students can also record themselves while reading their text. This is particularly helpful when students are in the earliest stages of writing development and a string of letters is difficult for the teacher to use to determine the students attempts at creating meaning. These recordings can be saved with the writing sample in the portfolio. Also, students can draw pictures, add labels, and compose text directly within the app. With minimal instruction, Mr. Adams's kindergarten students learned to do all of these tasks independently. Most importantly, students' uses of various writing platforms can be stored in one digital location allowing you to more accurately and easily follow each student's writing development.

Tip #5: Give Students Choice. Realistically, we may not always be able to give our students choices in the tools they use for the writing process. However, find the opportunities when you can parallel a writing task both digitally and with paper/pencil. For instance, you can assign one common writing task, such as "draw and write about your family." Students will then choose whether they want to do this writing on a piece of paper or on an iPad or other digital device. Students will be doing the *same* work on *different* writing platforms. Students will take ownership over their writing when given this autonomy and choice. They may also be more motivated to complete a writing task when they get to choose their writing tools.

Conclusion

Our students live in a digital age where technology is constantly evolving and new tools are emerging at a rapid pace. They are the true "digital natives" (Prensky, 2001, p. 1)—most having never known a world without digital tools such as smart phones, iPads, and laptops. Nearly all of our young students enter our classrooms like the students in Mr. Adams's kindergarten. With varying degrees of expertise, young children have already spent time using digital technologies as tools for learning (Neumann, 2016). As educators, it is our main goal to prepare our students for success in an ever-changing society. Providing opportunities for students to learn and engage with technology is important to this success. Some early educators and parents/guardians share concerns about the appropriateness of utilizing technology in the classroom setting at a young age (Brito et al., 2018). However, compliance with Common Core State Standards and examples of classrooms like that of Mr. Adams serve to move us forward. Young learners have the capability to develop necessary writing skills using *both* a pencil and digital devices in a developmentally appropriate manner. Furthermore, this parallel use of tools will prepare them for the continuous balance of digital and paper/pencil learning that they will experience throughout their K-12 education and beyond.

Taking the time to explicitly teach our children the means by which to use technology as a *learning tool* in the classroom, lays the foundation for their continuous growth and development as writers and as digital citizens. Furthermore, by giving students choice in their writing tools, we are able to model for students ways in which they can take ownership of their writing. Instead of stifling a student's development as either a digital writer or a paper and pencil writer, teachers have the opportunity to let both blossom alongside one another throughout the school year. Developmentally appropriate technology use *can* begin in a kindergarten classroom as students draw pictures, type letter strings, and compose text digitally.

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Appendix
Parent/Guardian Survey

Parental Use of Technology

Do you have any of the following devices at home? If so, how often do you use these items?

Device	Use at Home	How Often
Desktop Computer	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
Laptop	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
iPad or Tablet	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
Smart Phone	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
Email Account	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
Gaming System (Wii, Xbox, etc.)	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)

How many total devices do you have in your home? (If you have 3 iPads and 1 laptop, please mark as 4 devices, etc.)

0 1-2 3-4 5-6 7+

Technologies in the Home

Does your child use any of the following technologies at home or outside of school? If so, how often does he/she use these tools?

Device	**Use at Home**	**How Often**
Desktop Computer	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
Laptop	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
iPad or Tablet	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
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Email Account	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)
Gaming System (Wii, Xbox, etc.)	YES or NO	Rarely (less than once a week) Sometimes (weekly) Often (once a day) Very Often (two/three times a day)

Child's Technology Skills

How much experience does your child have with the following technologies?

Device				
Desktop Computer	No Experience	Little Experience	Still Learning (with help from parent)	Excellent (independent)
Laptop	No Experience	Little Experience	Still Learning (with help from parent)	Excellent (independent)
iPad/Tablet	No Experience	Little Experience	Still Learning (with help from parent)	Excellent (independent)
Smart Phone	No Experience	Little Experience	Still Learning (with help from parent)	Excellent (independent)
Email Account	No Experience	Little Experience	Still Learning (with help from parent)	Excellent (independent)
Gaming System (Wii, Xbox)	No Experience	Little Experience	Still Learning (with help from parent)	Excellent (independent)

Parental Attitudes About Technology

*Personal Use of Technology

Please indicate your level of agreement with the following statements.

I have good computer skills.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

I am comfortable learning and working with new technologies.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

I have a good overall knowledge of technology.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

*Children's Use of Technology

Please indicate your level of agreement with the following statements.

Technology is critical to the learning experience of students.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

My student should have regular access to technology in his/her classroom.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

I would like my child to use technology at school.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

I encourage my child to use technology at home.

No Opinion	Strongly Disagree	Disagree	Agree	Strongly Agree

How much value do you place on the use of technology in schools today?

Low 1	2	3	4	5 High

Demographics

With what gender do you identify? male female prefer not to respond

What is your age in years? 18-22 23-26 27-30 31-34 35-39 40-44 45 and older

How many children are in your home, including your kindergarten child?

What is the age of your kindergarten child? 4 5 6 other

Did your kindergarten child attend a preschool program? yes no

This survey can be accessed digitally: