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What Are Preadolescent Readers Doing Online? An Examination of Upper Elementary Students' Reading, Writing, and Communication in Digital Spaces

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ABSTRACT

The online reading, writing, and communication practices of students have been of significant interest to literacy researchers and teachers throughout the last several years, as insights into what students are currently doing in and outside of school can inform what they can be expected to know and be able to do in digital environments. Yet, little is known about the online activities, perceptions, preferences, and skills of preadolescent students. The present study reports the performance of 1,262 fourth and fifth graders on the Survey of Internet Use and Online Reading. Results were analyzed to determine whether there are gender differences in preadolescent students' Internet activities, perceptions, preferences, and skills. Findings from descriptive and comparative analyses of students' responses indicate that (a) preadolescent students in this study are moderately skilled at online search, evaluation, and communication tasks, with females scoring significantly higher on digital tasks than males; (b) preadolescent students engage in many digital tasks more frequently in school than outside of school; (c) despite reporting a preference for using the Internet, preadolescent students believe that it is more difficult to use it than to read a book, and believe that they would learn more from a book than from the Internet; and (d) there is a significant gender difference in students' skills and confidence related to digital tasks, and students' perceptions of their own skills may not align with their achievement on digital skills-based tasks.

Digital technology provides increasingly unique and versatile opportunities and contexts for reading, writing, and communicating. In 2013, it was reported that apps were added to the Apple iOS app store at the rate of 20,000 apps per month (Rowinski, 2013). Technology, such as apps, allows users to search for and curate information, remix information, share ideas in multiple modes and formats, connect in online communities, collaborate locally with others across the world, and more (Lankshear & Knobel, 2011; Leander, Phillips, & Taylor, 2010). Engaging with digital tools such as these requires a wide range of literacy skills, both traditional and digital (Gainer & Lapp, 2010; Gee, 2003; Hutchison, Beschorner, & Schmidt-Crawford, 2012; Moje, 2009). Users must learn how to use traditional and digital literacy skills simultaneously, as well as know how to combine paper and digital tools effectively, to maximize the affordances of digital tools and exploit them to meet their needs and to apply new methods of communication (Hutchison & Woodward, 2014a; Moje, 2009). Yet, previous research indicates that digital technology is integrated into literacy instruction at surprisingly low rates and only in rudimentary ways (Hutchison & Reinking, 2011).

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Thus, there is a need to support schools and teachers in understanding how to integrate digital technology into literacy instruction in a way that supports development of the full range of literacy skills that students need, builds on what students know and are able to do, and prepares students to be literate in a digital world. Accordingly, the purpose of this large-scale study (n = 1,262) was to provide a broad picture of how preadolescent students report that they read, write, and communicate with digital tools both in school and outside of school and to examine whether and how those differ, investigate how skilled students are at reading and writing online, understand students' preferences for reading in both print and digital contexts, and determine whether there are differences in students' activities, preferences, and skills based on gender.

The current study focused on preadolescents (typically defined as ages 9–12) because of the lack of studies that have focused on this age group. Most examinations of students' technology use have focused on teens (e.g., Ito et al., 2010; Lenhart, 2015; Madden, Lenhart, Cortesi, et al., 2013; Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). However, technology use starts well before the teenage years, and according to the Common Core State Standards, digital skills should be built in the elementary grades (National Governors Association Center for Best Practices & Council of Chief State School Officers [NGA Center & CCSSO], 2010). Additionally, the digital activities and preferences of preadolescents are likely to be different from those of teens. By understanding preadolescent students' digital literacy practices and preferences, we can better determine how digital technology can be integrated into instruction to meet students' needs and help them develop the full range of literacy skills needed to be literate in a world in which books and computers, as well as tablets and smartphones, are part of our daily lives.

Perspectives

Defining Literacy in Consideration of Digital Technology

As has been discussed among literacy scholars for many years (e.g., Coiro, 2003; Lankshear & Knobel, 2006; Leu, Kinzer, Coiro, & Cammack, 2004; Lewis & Fabos, 2005; Reinking, 1998), 21st-century definitions of literacy must take into account more than just a reader's ability to read and write printed text (National Council of Teachers of English, 2013). First, we must consider that readers today need to know how to read and write both printed and digital texts. This dualistic idea means that a reader not only should be able to decode alphabetic text but also must be able to make meaning from, and construct meaning with, images, sounds, videos, color, or some combination of all of those (Kress, 2003).

Additionally, because of the ubiquitous access to information available through both print and digital texts, readers must be savvy at locating information that is relevant to their needs and evaluating the validity and reliability of that information (Leu et al., 2004). To locate this information, readers must be able to navigate a digital device and understand a variety of contexts, vocabulary, and norms that are not normally associated with print-based texts. For example, readers need to understand concepts as simple as the purpose and function of a URL and, in many cases, may need to know the meaning of that term to complete a digital reading task. Alternately, readers may need to understand more complex terms (e.g., *download*, *plugin*) and concepts to locate the information they need, and the concept of account creation. Not only must readers know how to navigate digital environments and critically evaluate information, but they must also know how to effectively communicate with these tools (International Reading Association, 2009; Lankshear & Knobel, 2007).

Other literacy scholars (e.g., Gee, 1996; Lankshear & Knobel, 2007; Street, 1984) offered a sociocultural perspective of literacy that cautions against considering literacy practices without taking context and culture into account. Lankshear and Knobel suggested that literacy "is not a matter of knowing how to read and write a particular kind of script. Rather, it is a matter of 'applying this knowledge for specific purposes in specific contexts of use' (ibid.)" (p. 4). They further asserted that different texts require different backgrounds and skills to be read meaningfully. This view of literacy is particularly important in regards to digital technology because technology provides ever-changing contexts for applying literacy knowledge, many of which require particular kinds of background knowledge. Further, Lankshear and Knobel argued that multitasking with technology is ubiquitous among digital youths and is a way of operating in everyday life. This approach to literate activity is an important consideration as we consider what it means to be literate in the 21st century.

In addition to considering the context in which reading and writing exist and the ways in which readers and writers encounter and engage with text, Lankshear and Knobel (2007) also asked us to consider the ways in which readers and writers today can be contributors to the collective knowledge made available through the Internet rather than just be consumers of that information. Digital technology allows users to contribute in spaces such as blogs, wikis, and fanfiction sites; create videos and images; share photos and opinions; and potentially become valuable contributors through a variety of formats in a variety of domains (see, e.g.,

Andes & Claggett, 2011; Bogard & McMackin, 2012; Curwood & Cowell, 2011; Larson, 2009). However, these contributions require digital literacy skills, including everything from technical functions, such as capturing, posting, clicking, and saving information, to more critical skills, such as how to represent ideas through a combination of images, sounds, and words (Kress, 2003). Therefore, current understandings of what it means to be literate cannot exclude functional, creative, and critical skills required to contribute to digital texts in digital spaces.

Collectively, these perspectives suggest that readers and writers today engage in an increasingly diverse range of literacy activities that require an increasingly diverse range of skills and strategies. The survey in the current study was designed and analyzed with these perspectives and skills in mind.

Understanding Technology Use Inside and Outside of School

Previous research indicates that technology is used less frequently in literacy instruction than might be expected, given the ubiquity of digital technology (Hutchison & Reinking, 2011), and adolescent users are less skilled at reading and writing with digital technology than their status as digital natives (Prensky, 2001) might lead us to believe (Hutchison & Henry, 2010). However, students often have rich and active digitally literate lives outside of school, facilitated by digital technology (Alvermann, 2008; Alvermann et al., 2012; Black, 2009; Stewart, 2014). Further, it is common for culturally and linguistically diverse students to practice out-of-school digital activities that promote literacy.

For example, Stewart (2014) described a case study of four Latina/o adolescents who engaged in multiple types of digital literacy practices outside of school, such as communicating on Facebook, to learn English. Further, Black provided rich descriptions of the critical literacy practices that English leaners engaged in while digitally writing on fanfiction sites. In light of such research, Williams (2005) challenged teachers to consider students' out-of-school uses of digital technology, such as webpage design and participation in online role-playing games, as viable literacy practices that should be brought into the classroom. Such studies and calls to practice suggest the importance and prevalence of students' digital literacy practices outside of school. Yet, most of the research that exists regarding these practices focuses on adolescents at the middle or high school levels. Nevertheless, teachers at all levels of K–12 education are being urged to utilize digital tools in their instruction due to the prevalence of such tools in all learners' lives, and it may be useful to better understand the out-of-school digital literacy practices of other learners, such as preadolescents, to make connections to the classroom.

More recently, researchers from the MacArthur Foundation's Digital Youth Project (Ito et al., 2009) encouraged educators, parents, and policymakers to consider the value of providing opportunities for experimentation and social exploration as ways of developing literacy skills and practices. Ito et al. stated that "contrary to adult perceptions, while hanging out online, youth are picking up basic social and technological skills they need to fully participate in contemporary society" (p. 2). However, Williams (2005) asserted that teachers often perceive students' computer-mediated literacy practices as not serious enough. In other words, teachers do not believe that these activities teach valuable literacy skills, and instead hold the view that traditional reading activities are required for literacy learning. Yet, Hutchison and Henry (2010) found that students regularly engage in a wider variety of online reading and writing activities outside of school than they do inside school, and those activities should also be considered part of literacy development.

Further, Williams (2005) argued that another reason why teachers ignore students' online digital reading and writing practices is that they are unaware of how much time students spend on those activities. Since Williams's assertions in 2005 and Hutchison and Henry's findings in 2010, the prevalence of digital technology in the classroom has increased (PBS LearningMedia, 2013), and one-to-one laptop programs have likely become more common in schools. Thus, one purpose of the current study was to examine and compare preadolescent students' in-school and out-of-school digital literacy practices. Teachers can engage students in classroom activities in which they are invested and experienced by understanding the digital reading and writing practices that students participate in outside of school (Alvermann, 2002; Gee, 2003; Hawisher, Selfe, Moraski, & Pearson, 2004; Lankshear & Knobel, 2003).

Gender Differences in Technology Use

Another area in need of examination is gender differences related to digital technology use and skills, particularly given the growing concern over gender inequality in science, technology, engineering, and math (STEM) fields (Riegle-Crumb, King, Grodsky, & Muller, 2012; Sáinz & Eccles, 2012). Multiple studies have demonstrated differences in how males and females use digital technology and in their attitudes toward technology in general (e.g., Bunz, Curry, & Voon, 2007; Colley & Comber, 2003; Hakkarainen et al., 2000; Koch, Müller, & Sieverding, 2008). For example, Colley and Comber found that males use computer technology more frequently in out-of-school

contexts than do females and reported to like using computers more than females do. Across these studies and others, females' perceptions of their ability to use computers fluently and with expertise were lower than males' perceptions. However, no significant differences were reported regarding differences between males' and females' actual computer skills (Bunz et al., 2007; Hakkarainen et al., 2000; Koch et al., 2008).

Collectively, these studies highlight discrepancies in how females at the secondary and college levels perceive their computer skills as compared with males, leading to a growing consensus in the field that there is a need to promote digital competency and positive self-perception among females. Thus, further study is necessary to better understand these discrepancies in perceptions and, more importantly, to determine whether these discrepancies exist among preadolescents. Considering potential differences or similarities at the preadolescent level may inform understandings of when such discrepancies emerge among students, and provide a starting point for overcoming differences, as females' perceptions of their skills may affect their attribution of success or failure in working with digital technology (Koch et al., 2008).

Student Perceptions of Learning Through Print Versus Digital Text

A final perspective that supports the importance of the current study relates to the manner in which students perceive how they learn from print and digital media tools. Specifically, how do students view receiving information from more traditional print forms compared with receiving similar information from digital media?

Recent national survey data indicates that Americans value both print and digital forms of information (Pew Research Center, 2012). However, these findings suggest that digital sources are becoming more popular for receiving news and research, whereas print is still popular for pleasure or leisure-based reading and information. From an academic standpoint, reading and consuming information digitally is inherently different from receiving information from a print-based text (Coiro, 2011; Lankshear & Knobel, 2011), and students must apply additional literacy strategies when learning through online or digital forms of text (Leu et al., 2004).

Yet, less is known about how K–12 students, particularly preadolescents, perceive their experiences with learning and receiving information online versus in print. The research that exists indicates that students, particularly those who struggle, are more motivated to participate in digitally based literacy activities when provided the opportunity and that such activities might provide a sense of agency and empowerment among students who often struggle with traditional print-based reading activities (O'Brien, Beach, & Scharber, 2007). Thus, an additional purpose of this study was to examine preadolescents' perceptions of their experiences with print and digital media.

Research Questions

The current study was designed to answer four research questions, focused on preadolescents participating in this study:

1. How skilled are preadolescent students at reading and writing online?
2. What types of Internet activities do preadolescents engage in inside and outside of school, and how does their in-school and out-of-school use differ?
3. How do preadolescent students' perceptions of reading information through various forms of print and digital media compare?
4. Are there gender differences in preadolescent students' Internet activities, perceptions, preferences, and skills?

Method

Setting and Participants

A survey was conducted across five schools in a suburban school district in a Midwestern state in the United States. The school district was selected because it had a one-to-one laptop program through which all students received a Chromebook for both in-school and out-of-school use. The survey was administered to fourth- and fifth-grade students in the district (n = 1,262) in fall 2014. Table 1 provides a profile of the participants, including their access to digital devices outside of school. As a group, the participants were predominantly white, which is reflective of the school district as a whole. The percentage of students eligible for free or reduced-priced lunch reported for the 2014–2015 school year ranged from 7.8% to 33.1% in the participating schools, whereas the district as a whole has a rate of 13.1%. The participants in the study were slightly more racially/ethnically diverse than the district as a whole, with 86% of the participants being white, whereas the student population of the district is 91% white.

Survey Instrument

An existing survey, the Survey of Internet Use and Online Reading (Hutchison & Henry, 2010), was used

TABLE 1
Digital Profile of Participants (*n* = 1,262)

	Number of respondents	Percentage of all respondents
Gender		
Male	614	48.7%
Female	648	51.3%
Grade		
4	565	44.8%
5	697	55.2%
Race/ethnicity		
White (European American)	1,031	81.6%
African American	32	2.5%
Latino	26	2.1%
Asian/Pacific Islander	26	2.1%
Multiracial	38	3.0%
Other	109	8.7%
Digital device in the home		
Yes	1,247	99.0%
No	15	1.0%
Has a digital device of their own		
Yes	1,121	88.8%
No	141	11.2%
Places where they use the Internet		
School	1,147	87.1%
Home	1,203	91.6%
Public library	359	27.1%
Relative's house	729	56.0%
Friend's house	712	55.4%
Other	124	9.4%
Amount of time using digital device in the past year		
Has increased	532	42.4%
Has decreased	206	16.3%
Has stayed the same	505	40.0%
Unknown	19	1.3%

in the current study. The survey is a valid and reliable instrument designed to measure the following three constructs related to digital literacy: (a) use of Internet tools, (b) online reading materials, and (c) Internet-based literacy skills. The first construct was designed to identify the types of digital tools students use to read, write, and communicate online. The second construct was designed to gauge students' perceptions about reading online and their self-perceptions of their skills at reading and writing digitally. The third construct was designed to measure students' abilities to navigate digital environments and to locate, evaluate, synthesize, and communicate digital information. Because technology changes so rapidly, we modified the survey to include updated technology applications and remove items that were no longer relevant.

Specifically, we revised the Internet-Based Literacy Skills Scale to reflect more current methods of reading and writing with technology. Changes included the addition of items about how to share information with apps and through Google Docs and the revision of item wording, where applicable, from *computer* to *digital device* to reflect a broader range of devices used for digital activities. Because we revised this scale, we examined the validity and reliability of the survey. However, because the first construct of the survey (use of Internet tools) is intended to measure frequency and the items are not combined to form a scale, it was not necessary to perform such analyses on items in the first construct.

Although none of the items related to the second construct (online reading materials) were changed from the original survey, we still evaluated the internal consistency of these items because they were intended to provide collectively an understanding of students' perceptions related to online reading materials. Cronbach's α for these items was .82, which confirms that they are closely related and that the scale is reliable.

Because new items were added to the third construct of the survey (Internet-based literacy skills), we conducted a principal axis factor analysis with varimax rotation on the 13 items to identify grouping patterns among the types of literacy skills students were asked to demonstrate through these items. Factor analysis is a data reduction technique used to determine the extent to which individual questions relate to a factor or concept. Factor analysis can be used to group highly intercorrelated items into a single factor, which is useful for studying concepts that are not easily directly measured. We conducted an initial analysis to obtain eigenvalues for each factor in the data. Based on the Kaiser criterion, factors with an eigenvalue greater than 1 explain more variance than a single observed variable. In our analysis, two factors had eigenvalues over 1 and, in combination, explained 42.4% of the variance.

Table 2 shows the factor loadings, which demonstrate the relationship of the variables to the underlying factor. The items that clustered on the same factor were labeled to represent the related concept among the items in the factor. The first factor, Vocabulary Knowledge of Digital Terms, includes four items related to understanding of

TABLE 2
Summary of Exploratory Factor Analysis Results for Uses of Digital Tools

Factor	Item loadings	Number of items
Vocabulary Knowledge of Digital Terms	0.53–0.73	4
Internet Search, Evaluation, and Communication Skills	0.54–0.71	8

vocabulary terms associated with working online, such as *URL* and *PDF download*. Item loadings for this factor ranged from 0.53 to 0.73. The second factor, Internet Search, Evaluation, and Communication Skills, includes seven items related to formulating questions to search online, locating relevant resources, evaluating resources, and communicating information online. Item loadings for this factor ranged from 0.54 to 0.71. Three items did not load onto either of these factors and are thus not thought to be related to the factors being measured. Therefore, those three items were removed from the analysis.

Survey Administration

The survey was administered to students during their library media class by each school's library media specialist at the request of district leaders who desired this arrangement because library media specialists were the teachers in the district who were primarily responsible for teaching and assessing students' digital literacy skills and would be most skilled at answering students' questions. The researchers met with all of the library media specialists prior to administration of the survey to share the survey, explain its purpose, and describe the requirements for administering it. Each library media specialist read each item of the survey aloud to students as they followed along on their own computers to ensure that reading the questions was not a barrier to students' responses. Further, the library media specialists were instructed that they could answer any questions that students had about individual items and make clarifications as needed. Thus, students were able to ask questions about the survey items at any point during the survey. The library media specialists initially had concerns about the length of the survey, so it was divided into two parts and administered over two different class periods to alleviate concerns about students becoming fatigued during the survey. Further, the library media specialists explained to students why they were taking the survey (to inform not only university researchers but also the content of their upcoming instruction) and encouraged them to give their best effort in completing it.

Data Analysis

We began the data analysis by examining the students' surveys for completeness. Because the survey was conducted in a supervised school setting with ample time to respond, only 11 surveys were incomplete and thus omitted from data analysis, resulting in 1,262 completed surveys. The survey included a variety of item formats that were analyzed in several different ways. Items related to the first and second constructs, use of Internet tools and online reading materials, were mostly multiple-choice and multiple-response items designed to measure the frequency with which students engage in various activities and their preferences for doing so. Thus, these items were analyzed descriptively and using *t*-tests to look for differences among groups. These analyses are described, as relevant, throughout the Results section.

The items related to the third construct, Internet-based literacy skills, included both multiple-choice and open-ended items, which were each scored for correctness. The multiple-choice items were given a score of 1 if they were correct and a score of 0 if they were incorrect. In addition to multiple-choice items, there were six open-ended task items on the survey designed to measure students' Internet search, evaluation, and communication skills. For example, students were asked questions such as "Your teacher asks you to use the Internet for a research project about Ancient Egypt. Please write one question about what you'd like to discover about Ancient Egypt." These open-ended items were scored using a rubric developed by the original authors of the survey. Using the rubric, two scorers independently scored the first 50 responses for each open-ended item and calculated their percentage agreement on each item. The scorers discussed each item for which there was not agreement until consensus was reached.

Based on this revision, the scorers independently coded 50 additional responses and calculated their percentage of agreement on the item scores. The percentage of agreement was above the set threshold of 90% for each item, so the remaining responses were coded independently. Figure 1 shows the rubric used to score the question about Ancient Egypt. All of the items were scored with a similar rubric, with possible scores ranging from 0 to 3.

Finally, we conducted a content analysis (Neuendorf, 2002) of the open-ended responses for question 12, which asked, "Explain how you could share information from the app in the picture above with your teacher. Which method would you choose and what steps would you take to share the information?" Responses were open coded by reading each response and labeling it with a general descriptor of the type of response that was

FIGURE 1
Example of Rubric Used to Score Open-Ended Items on the Survey

Formulate Questions - Item 39

Your teacher asks you to use the Internet for a research project about Ancient Egypt. Please write one question about what you'd like to discover about Ancient Egypt.

	0	Less Skilled 1	Moderately Skilled 2	Highly Skilled 3
Precision	Makes no attempt (I don't know)	Question is too broad, lacking in specificity or not well defined. (uses pronouns in place of names. Ex: they or it)	Multiple questions are asked, or the question is multifaceted, requiring multiple searches.	Question is targeted, specific, and focused.
Relevancy	Makes no attempt (I don't know)	Question not relevant to the context (information for a school report)	Question is somewhat relevant to the context (information for school report).	Clear and direct. Question is implicitly relevant given the context (information for a school report).

Skill – Formulate Questions combine with Clarity

Highly Skilled Characteristics (3)	*Example(s) of student response(s)*
Term "ancient" AND phrase "Egypt" must be in question OR a specific element of ancient Egypt must be mentioned (Ex: pyramids, mummies, etc.) A specific question about Ancient Egypt must be asked. The question must be phrased as a question. Response is clear and understandable. Response is fluent and cohesive Response is well organized Question is precise, on topic (Ancient Egypt) and defined well enough for a key word search.	What are some of Ancient Egypt's myths? Why did the ancient Egyptians wrap up the dead and make mummies?
Moderately Skilled Characteristics (2)	*Example(s) of student response(s)*
Question lacks specificity. Question is not well defined. Lack of precision makes key word searching difficult/impossible.	How ancient is it and why is it ancient?
Less Skilled Characteristics (1)	*Example(s) of student response(s)*
Question is not on topic (Ancient Egypt). Question is too broad for a key word search.	What cultures were involved? Were (sic) did they live?
(0)	*Example(s) of student response(s)*
Makes no attempt (I don't know) OR Question is off topic and irrelevant.	What are they doing?!

provided. As categories of response emerged, codes were developed and applied to each response until no new codes emerged. After all data were initially coded, the coding categories were reviewed to look for overlap. Several coding categories were then collapsed or removed due to overlap or lack of relevance. All data were then examined and coded again with the finalized coding scheme.

Results

In this section, we report results organized by each research question. The fourth research question, regarding gender differences in students' activities, perceptions, preferences, and skills, is not reported separately. Rather, it is answered in tandem with, and in relationship to, the first three research questions.

How Skilled Are Preadolescent Students at Reading and Writing Online?

To answer this research question, students were asked about their perceptions of their skills on a variety of digital reading and writing activities, as well as to engage in a series of digital tasks that measured their skills. To gauge their self-perceptions, students were asked to rate themselves from 1 (*beginner*) to 7 (*expert*) on a series of digital reading and writing activities. Overall, students perceived themselves as most skilled at using a computer in general and least skilled at typing homework assignments. Independent sample *t*-tests indicated that there was a significant gender difference in self-perception for three of the self-perception items. On average, males perceived that they were more skilled at searching for information online ($t = 1.58$, $p = .01$) and telling someone else about something that they read on the Internet ($t = 1.93$, $p = .02$). Females perceived that they were more skilled at typing homework assignments ($t = -1.33$, $p = .04$). Table 3 provides an overview of students' self-perceptions of their skills.

In addition to reporting perceptions of their skills, students were asked to complete digital tasks gauging their vocabulary knowledge of digital terms and their Internet search, evaluation, and communication skills. Table 4 provides information about the questions used to evaluate each of the skill areas, the mean score and percentage of students answering correctly on multiple-choice items, the mean scores for open-ended items that were scored with a rubric, and an example of responses on open-ended items (for a complete list of items used in this part of the survey, see the Appendix, which is available as supporting information for the online version of this article).

TABLE 3
Students' Self-Perceptions of Digital Skills

Digital activity	Mean (standard deviation)
Using a computer, tablet, or smartphone in general	5.99 (1.71)
Using the Internet in general	5.85 (1.67)
Reading information online	5.24 (1.70)
Searching for information online	5.22 (1.61)[a]
Using the Internet to answer a question	4.92 (1.89)
Writing and sending text messages	4.62 (2.28)
Telling someone else about something you read on the Internet	4.33 (2.10)[a]
Typing homework assignments	4.12 (2.14)[b]

[a]Males perceived themselves as more skilled at this activity than did females, $p < .01$. [b]Females perceived themselves as more skilled at this activity than did males, $p < .01$.

Scores from each item in Table 4 were summed to create a composite score for each student, called the digital skills score, to gain a sense of students' overall level of digital skills. With all items combined, a composite score of 27 was possible. The mean digital skills score for all students was 13.61. This score indicates that the students in this sample are moderately skilled at navigating, reading, and writing online. The mean digital skills score was 14.43 for females and 12.69 for males. An independent samples *t*-test revealed that the mean score for females was significantly higher than that of males ($t = -5.36$, $p < .01$, $df = 1{,}044$).

Among the items related to Internet search, evaluation, and communication skills, the lowest scores were for items related to communicating information (questions 11 and 12). These two questions were from a two-part survey item. The first part of the item, question 11, asked students to identify an app function based only on images of icons accompanied by a single word describing the meaning of the icon (see Figure 2). The second part of the item, question 12, asked students to explain how they would share information from the app in the picture. A content analysis (Neuendorf, 2002) of the open-ended responses for question 12 revealed 14 categories of responses that students most commonly provided (see Table 5).

What Types of Internet Activities Do Preadolescents Engage in Inside and Outside of School, and How Does Their In-School and Out-of-School Use Differ?

To answer these research questions, students were asked to respond to a Likert-type scale to report how often they use the Internet for a variety of reading and writing activities both inside and outside of school. Table 6 compares students' reported frequency on these in- and out-of-school activities. Means and standard deviations in the table were computed from students' responses on the scale, which were assigned values as follows: 0 (*never*), 1 (*less than one time a week*), 2 (*one time a week*), 3 (*two or three times a week*), 4 (*one time a day*), and 5 (*several times a day*). The last column in the table indicates the difference between the mean values for in- and out-of-school frequency for each activity, whether they are significantly different, and whether the differences vary by gender.

Comparing the frequency of the digital reading and writing practices that students reported revealed several patterns. First, for all but four activities, there was a statistically significant difference in the extent to which students reported participating in each activity in school

TABLE 4
Items and Scores for Students' Vocabulary Knowledge of Digital Terms and Internet Search, Evaluation, and Communication Skills

Question	Percentage answering correctly	Range of possible scores	Mean score (standard deviation)	Example of a student response
Vocabulary knowledge of digital terms				
1. "You are reading on this website and want to get back to the main starting page. Where would you click?" (accompanied by an image with keywords)	84.0	0–1	0.89 (0.32)	NA (multiple choice)
2. "You find this great website and your teacher asks, 'What is the URL?' Your teacher wants to know:" (accompanied by an image)	28.0	0–1	0.30 (0.46)	NA (multiple choice)
3. "Select the best definition for the word 'plugin' as it is used in this message:" (accompanied by an image of a message stating that a plugin is required)	31.7	0–1	0.34 (0.47)	NA (multiple choice)
4. "What will you need on your computer to read this file?" (accompanied by an image referring to a PDF reader)	12.4	0–1	0.13 (0.34)	NA (multiple choice)
Internet search, evaluation, and communication skills				
5. Part 1: "Your teacher asks you to use the Internet for a research project about Ancient Egypt. Please write one question about what you'd like to discover about Ancient Egypt."	NA (rubric score)	0–3	1.66 (1.02)	"Why did the ancient Egyptians wrap up the dead and make mummies?"
6. Part 2 of question 5: "Then, list two different keyword or search phrases you might use to help locate an answer to that question."	NA (rubric score)	0–3	1.47 (1.16)	"Ancient Egypt King Tut; History of Ancient Egypt"
7. "If you were looking for information about Ancient Egypt to write a report in Social Studies, which website would be likely to give you the most useful and reliable information?" (accompanied by an image of website descriptions)	37.8	0–1	0.40 (0.50)	NA (multiple choice)
8. "Please rate the reliability of the following websites for information about the rainforest." (accompanied by a variety of URLs)	NA (multiple correct answers)	0–4	2.37 (0.91)	NA (multiple choice)
9. "After searching, you found a lot of interesting information about Ancient Egypt on the Internet. Your teacher wants you to make a report to share with the class. What are some ways you could use your digital device to present your information and the sources you used?" (accompanied by an image showing options for sharing)	NA (rubric score)	0–3	1.09 (0.95)	"Make an Animoto Video with info on how many kings & queens of Egypt there were & who they were & at least 3 pics to make it interesting & educational."
10. "What steps would you take to check if the information on this webpage is correct?" (accompanied by an image of a website)	NA (rubric score)	0–3	1.06 (1.00)	"See when it is published; copyright; Go to another website you know has true info to check & see if this page is false; WHO published it; Use your background knowledge"
11. "You come across this screen when working in an app. What do the icons on this screen allow you to do?" (accompanied by an image showing options for sharing information from an app)	NA (rubric score)	0–3	0.88 (0.91)	"Mail it to someone through the internet. Tweet it. Send it through a message. Facebook."

(continued)

TABLE 4
Items and Scores for Students' Vocabulary Knowledge of Digital Terms and Internet Search, Evaluation, and Communication Skills *(continued)*

Question	Percentage answering correctly	Range of possible scores	Mean score (standard deviation)	Example of a student response
12. "Explain how you could share information from the app in the picture above with your teacher. Which method would you choose and what steps would you take to share the information?" (accompanied by an image showing options for sharing information from an app)	NA (rubric score)	0–3	0.72 (0.99)	"Mail; Click Mail; Type in your teachers email address/click her contact; click send"
Total possible score for all items combined		27		
Mean score for all items combined		All students: 13.61 Males: 12.69 Females: 14.43		

Note. NA = not applicable.

and outside of school. For 12 out of the 19 activities that were significantly different, students reported participating in those activities more frequently at school. Additionally, males reported engaging in five of the activities outside of school at significantly higher rates than females did. Females engaged in only one out-of-school activity (creating documents) at significantly higher rates than males did. Likewise, males reported engaging in three in-school activities at significantly higher rates than females did. Females reported engaging in one in-school activity at significantly higher rates than males did.

How Do Preadolescent Students' Perceptions of Reading Information Through Various Forms of Print and Digital Media Compare?

To address this research question, students were asked to answer a series of questions about which activities (reading a book, watching television, or using the Internet) they preferred, which of these activities were most difficult, and which they learned more from. Table 7 reports students' preferences for various pairings of these activities.

Chi-square goodness-of-fit tests were performed to determine whether the activities in each comparison were equally preferred. Results indicated that preferences were not equally distributed for any of the comparisons. Students preferred watching television over reading a book, $\chi^2(1, 1{,}262) = 31.92$, $p < .001$; using the Internet over watching television, $\chi^2(1, 1{,}262) = 26.37$, $p < .001$; and using the Internet over reading a book, $\chi^2(1, 1{,}262) = 9.94$, $p < .01$.

Chi-square tests of independence indicated that there was also a significant relationship between preference and gender for each comparison. Males preferred watching television over reading a book, whereas females showed no preference, $\chi^2(1, 1{,}262) = 36.91$, $p < .001$; more males than females preferred using the Internet over watching television, $\chi^2(1, 1{,}262) = 6.35$, $p < .05$; and males preferred using the Internet over reading a book, whereas females preferred the opposite, $\chi^2(1, 1{,}262) = 42.86$, $p < .001$.

In addition to their preferences, students reported on which activities would be more difficult for them. Table 8 reports those pairings and indicates whether there were significant relationships between perceived difficulty and gender for each comparison.

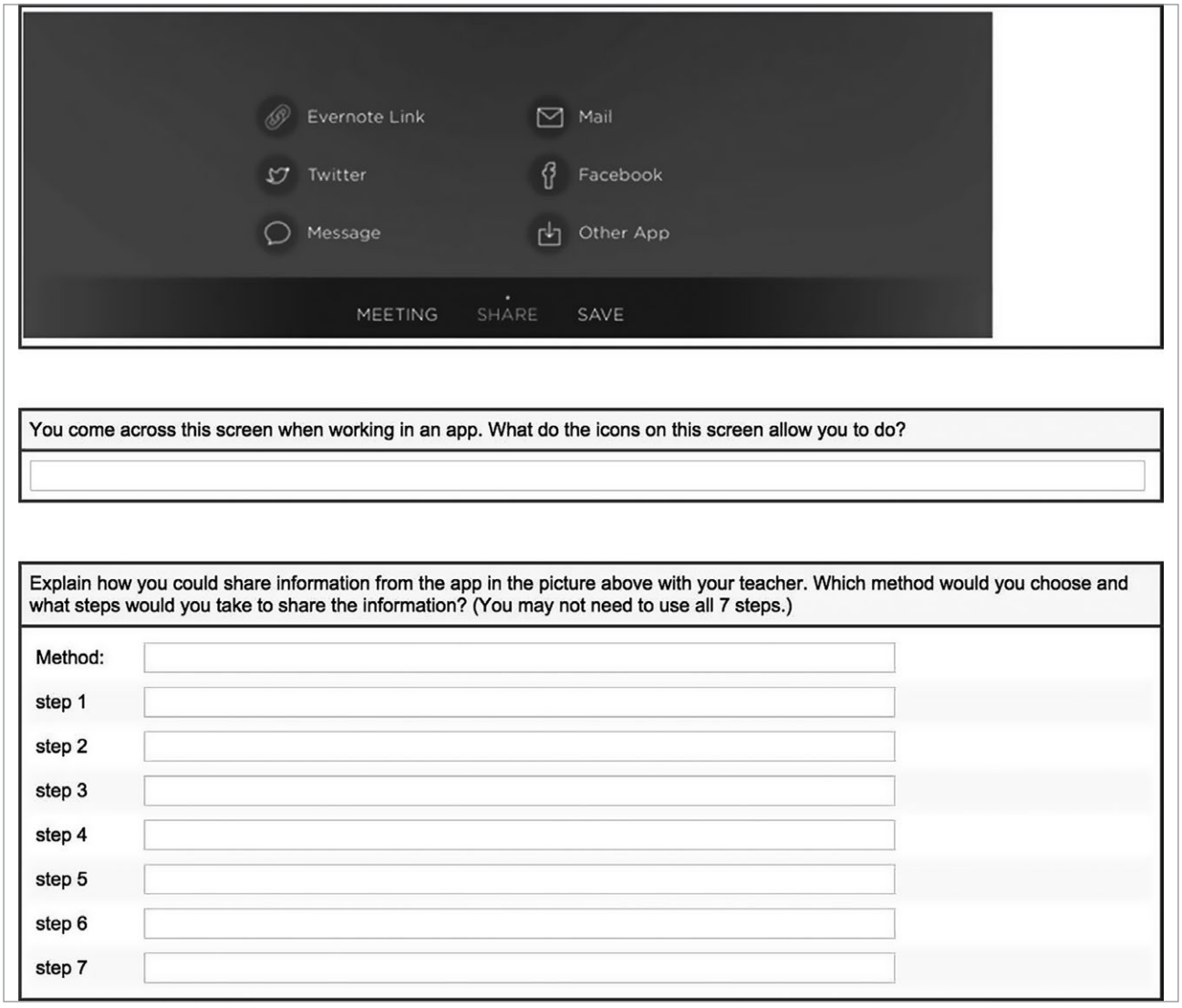
Chi-square goodness-of-fit tests indicated that students' perceptions of difficulty were not equally distributed for any of the comparisons. Students perceived that reading a book was more difficult than watching television, $\chi^2(1, 1{,}262) = 119.22$, $p < .001$; and that using the Internet was more difficult than both watching television,χ^2 $(1, 1{,}262) = 146.45$, $p < .001$; and reading a book, $\chi^2(1, 1{,}262) = 32.38$, $p < .001$.

Chi-square tests of independence indicated that there was also a significant relationship between students' perceived difficulty and gender in two of the comparisons. More males than females perceived that it would be more difficult to read a book than to watch television, $\chi^2(1, 1{,}262) = 15.01$, $p < .001$. More females than males perceived that it would be more difficult to use the Internet than to read a book, $\chi^2(1, 1{,}262) = 16.23$, $p < .001$.

Students also indicated which activities they believed they would learn more from. Table 9 reports those results.

Chi-square goodness-of-fit tests indicated that students' perceptions about which resource they would learn more from were not equally distributed for any of the comparisons. Students perceived that they would

FIGURE 2
Survey Questions 11 and 12



learn more from reading a book than watching television, $\chi^2(1, 1{,}262) = 481.78$, $p < .001$. Students also perceived that they would learn more from using the Internet than from watching television, $\chi^2(1, 1{,}262) = 662.16$, $p < .001$; or reading a book, $\chi^2(1, 1{,}262) = 3.70$, $p = .05$.

Chi-square tests of independence indicated that there also was a significant relationship between preference and gender in two of the comparisons. More females than males perceived that they would learn more from reading a book than watching television, $\chi^2(1, 1{,}262) = 17.83$, $p < .001$. Males perceived that they would learn more from using the Internet than reading a book, whereas equal percentages of females perceived that they would learn more from both sources, $\chi^2(1, 1{,}262) = 5.79$, $p < .05$.

Discussion and Implications

Results from this survey should be interpreted in light of the sample with which this study was conducted, which was primarily white students in a relatively affluent school district in which students had pervasive access to digital technology. Using the same survey with adolescents in a previous study, Hutchison and Henry (2010) found that white and Asian American adolescents were more skilled at the online reading tasks than were African American and Hispanic/Latino adolescents. Thus, our results may represent a higher level of skills than the results would with a more diverse sample.

Although the increasing popularity of mobile devices, such as smartphones, has reduced discrepancies

TABLE 5
Types of Responses Provided by Students for Question 12

Response category	Description of category	Percentage of responses in the category
1. I don't know/incomplete	The student responded with "I don't know" or provided an incomplete response that could not be interpreted, or the response did not make sense for the question.	57.0
2. Description of a process	The student provided a reasonable description of a process that he or she would undertake to share the information. Although reasonable, the process described was not always correct.	16.9
3. Keyword description	The response included only keywords that were found in the image provided and did not provide additional information illustrating understanding of the app functions.	6.6
4. Description of alternate tool	The student described a process for sharing information, but it was not connected to options provided in the image (e.g., described sharing with a Google Doc).	4.5
5. Shortcuts and commands	The student described specific shortcuts or commands that he or she would use to save or share information.	3.4
6. Icon tapping	The student described the idea that tapping an icon in the image would share the information, and showed an overreliance on the icon.	2.9
7. Show the teacher in person	The student described how he or she could show the teacher his or her work in person instead of using one of the tools shown in the image, or the student noted that he or she would directly ask the teacher how to share the information.	2.8
8. Consider appropriateness	The student described how he or she would check to make sure that the method of sharing was safe, expressed a concern about privacy or getting permission from the teacher, or described a need to evaluate the reliability of the information being shared.	2.7
9. Take a screenshot	The student described a method involving taking a screenshot of his or her work and sharing the information that way.	2.3
10. Explore the tools	The student described an approach that involved clicking around or trying out functions to see what happens.	2.1
11. Backing out of the app	The student described a need to hit the Back button or exit the app or screen because he or she did not understand what to do or how to use it.	2.0
12. Ask for help	The student described a need to ask a peer, teacher, or family member for help because he or she did not know what to do.	1.6
13. Use of an embed code	The student discussed using an embed code to share his or her information.	1.2
14. Combination of methods	The student described a combination of approaches, including use of multiple digital methods, both paper and digital methods, Xand in-person and online methods.	1.0

in access to digital technology among various economic, racial, and ethnic groups (Perrin & Duggan, 2015), there is some evidence that students in more economically disadvantaged districts are required to use the Internet less at school and are less skilled at online reading than students in economically advantaged districts (Leu et al., 2015). Thus, these findings should be interpreted in light of the sample with which the study was conducted.

Reflecting on the State of Technology Integration in and Outside of School

Results of the current study indicate that for this school district, technology integration seems to be occurring with greater frequency and variety than reported in previous studies on the rate of technology integration. For example, in their 2011 national survey, Hutchison and

TABLE 6
Means (and standard deviations) of Reported Frequency of Students' Digital Activities Inside and Outside of School

Digital activity	In-school frequency *M* (*SD*)	Out-of-school frequency *M* (*SD*)	Difference between *M*s for in- and out-of-school frequencies
Creating a document (e.g., Word, Google Doc)	2.27 (1.60)	0.88 (1.33)[a]	1.39**
Gathering images online	1.61 (1.37)	1.28 (1.54)	0.32**
Creating images (e.g., drawing, using digital programs)	1.04 (1.25)	0.87 (1.41)	0.17**
Reading a digital book or story (e.g., online, on a Kindle, with a reading app)	1.23 (1.44)	1.19 (1.54)	0.05**
Watching a video online	2.11 (1.69)[b]	2.96 (1.81)[b]	−0.86**
Creating a video (e.g., to post on YouTube, with Jing)	0.47 (1.08)[b]	0.62 (1.32)[b]	−0.14**
Listening to information online (e.g., podcast)	1.32 (1.35)	0.94 (1.43)[b]	0.38**
Creating a multimedia presentation with images, sound, and text (e.g., with VoiceThread or Prezi)	0.99 (1.18)[a]	0.57 (1.17)	0.41**
Publishing information to social networking sites (e.g., Twitter, Facebook, Edmodo)	0.49 (1.17)	0.67 (1.40)	−0.18**
Gathering information through social media (e.g., finding an answer to a question by searching Twitter or posting it to Facebook)	0.57 (1.21)	0.60 (1.26)	−0.03
Posting or gathering resources through social bookmarking sites (e.g., Delicious, Diigo, Pinterest)	0.63 (1.15)	0.56 (1.21)[b]	0.06
Using reference sites online (e.g., Dictionary.com, Wikipedia)	1.68 (1.46)	1.09 (1.43)	0.60**
Using a graphic organizer tool (e.g., Popplet, Inspiration)	0.90 (1.22)	0.43 (0.97)	0.48**
Writing or drawing on digital text (e.g., highlighting or making notes using Evernote or Diigo)	1.04 (1.39)	0.66 (1.23)	0.39**
Submitting work online (e.g., using Google Drive, Blackboard, or Dropbox)	1.69 (1.63)	0.79 (1.33)	0.90**
Reading fanfiction	0.59 (1.18)[b]	0.53 (1.18)[b]	0.07
Writing and publishing fanfiction	0.54 (1.14)	0.34 (0.97)[b]	0.22**
Using iPad apps to practice a lesson (e.g., spelling, math)	1.10 (1.47)	1.01 (1.44)	0.12**
Using iPad apps to create products that use images	0.51 (1.12)	0.62 (1.30)	−0.10**
Using iPad apps to create products that use sound recordings	0.50 (1.10)	0.65 (1.31)	−0.15**
Using iPad apps to create products that use text, images, video, and/or audio together	0.62 (1.19)	0.76 (1.39)	−0.14**
Searching for information online	2.70 (1.55)	2.05 (1.67)	0.66**
Collaborating or chatting online with students from other classes	0.60 (1.23)	1.53 (1.91)	−0.92**

Note. *M* = mean; *SD* = standard deviation.[a]Females reported a significantly higher *M* frequency than males did for that activity, $p = .05$. [b]Males reported a significantly higher *M* frequency than females did for that activity, $p = .05$. **$p < .01$.

TABLE 7
Students' Activity Preferences: "Which Would You Rather Do?"

Comparison items	Read a book	Watch television	Use the Internet
Read a book or watch television			
All students***	41.6%	58.4%	—
Males	32.4%	67.6%	
Females	50.3%	49.4%	
Watch television or use the Internet			
All students*	—	42.3%	57.7%
Males		38.5%	61.5%
Females		46.0%	54.0%
Use the Internet or read a book			
All students***	45.3%	—	54.7%
Males	35.3%		64.7%
Females	54.9%		45.1%

*Significant relationship between preference and gender, $p < .05$. ***Significant relationship between preference and gender, $p < .001$.

TABLE 8
Students' Perceptions of Difficulty of Activities: "Which Would Be More Difficult for You?"

Comparison items	Read a book	Watch television	Use the Internet
Read a book or watch television			
All students***	66.7%	33.3%	—
Males	72.4%	27.6%	
Females	61.3%	38.7%	
Watch television or use the Internet			
All students	—	31.5%	68.6%
Males		31.9%	68.1%
Females		31.0%	69.0%
Use the Internet or read a book			
All students***	41.2%	—	58.8%
Males	47.6%		52.4%
Females	35.3%		64.7%

*Significant relationship between perceived difficulty and gender, $p < .05$. ***Significant relationship between perceived difficulty and gender, $p < .001$.

Reinking found that technology integration in literacy and language arts classrooms as a whole was relatively low and that literacy and language arts teachers faced many obstacles to integration. However, the current study revealed that students participated in a wide range of digital activities in school. Further, students reported that they engaged in more than half of the reported activities with significantly greater frequency in school than out of school. When compared with Hutchison and Henry's (2010) findings from a study using the same survey, this finding may represent a shift in the level of digital activity and instruction that is being integrated into classrooms. Although Hutchison and Henry's study was conducted with adolescents rather than preadolescents, students in that study were more likely to participate in a majority of the activities outside of school than they were in school. However, in the current study, it was more common for students to engage in the listed

TABLE 9
Students' Perceptions of Learning With Each Activity: "Which Would You Learn More From?"

Comparison items	Read a book	Watch television	Use the Internet
Read a book or watch television			
All students***	83.3%	16.7%	—
Males	78.4%	21.6%	
Females	88.0%	12.0%	
Watch television or use the Internet			
All students	—	11.0%	89.0%
Males		12.3%	87.7%
Females		9.7%	90.3%
Use the Internet or read a book			
All students*	47.1%	—	52.9%
Males	43.3%		56.7%
Females	50.6%		49.4%

*Significant relationship between preference and gender, $p < .05$. ***Significant relationship between preference and gender, $p < .001$.

activities at school. This shift may indicate an increased use of digital technology in classrooms.

Yet, upon examining the types of digital activities in which students engage at school, the state of technology use for digital reading, writing, and communication is slightly less optimistic. Many of the activities in which students engaged most frequently at school involve consumption of information rather than engagement in creative media production. For example, the most frequent in-school activities were searching for information online, creating documents, watching videos online, submitting work online, and using reference websites. Students were not heavily engaged in information production activities, such as creating their own videos, or in activities involving collaborations beyond the classroom walls.

Relatedly, students also did not frequently engage in these activities in out-of-school contexts. Buckingham (2007) argued that even when youths have at-home access to digital technology, they rarely apply digital tools to creative media production unless socialized into these practices. This finding seems to be true of students in the current study as well, indicating the important role that teachers may play in modeling and encouraging creative media production among students.

Social network activities, such as gathering information through social media, social bookmarking, and writing and publishing fanfiction, were some of the least common activities reported. For these preadolescents, using the Internet to consume information was more common than using the Internet to communicate and connect with others online. Certainly, the findings about social network engagement are not completely surprising because many social network sites, such as Facebook, require a minimum age of 13 to create an account. Yet, these findings may be important when considering that in a few years' time, these preadolescents will most likely join the large number of adolescents who engage in social media (Madden, Lenhart, Cortesi, et al., 2013), but have had little exposure to such resources in or outside of school.

This finding on preadolescents' use of social media is further concerning when considered in light of a recent poll (University of Phoenix, 2015) in which 87% of teachers across the United States reported that they have not integrated social media into the classroom. Further, the percentage of teachers reporting reluctance to integrate social media has increased since 2013 (University of Phoenix, 2015). Such findings are concerning in that the activities that engage preadolescents in these types of social spaces online might be useful for their development of skills and appropriate protocol related to such online activity. For example, providing students with social media experience by using education-based sites such as Edmodo in school settings that are guided and monitored closely by a teacher in a more controlled classroom environment that promotes social Internet safety and etiquette may carry over into out-of-school experiences with social media. Otherwise, these sites become a space where students engage in trial and error through participation. It is also interesting, albeit outside of the scope of this study, that two of the preadolescents' most common online activities take place in both in- and out-of-school settings,

raising questions regarding the influence of school Internet practices on home practices and vice versa.

Survey results indicated that these preadolescent students were at least moderately skilled at navigating, reading, and writing online, but even when they did not know or did not indicate that they knew formal procedures for these types of Internet activities, they were creative in finding alternative methods for locating and sharing information online. Similarly, Colwell, Hunt-Barron, and Reinking's (2013) study regarding students' online reading comprehension found that students brought with them to the classroom online search practices that they had developed on their own outside of school. The researchers, too, found these procedures to be creative, although not always optimally productive, in searching for, locating, and evaluating information online. However, that study focused on seventh-grade students who may have exhibited more independence in their online activity, whereas findings from the current study highlight the practices that preadolescents might creatively use. Yet, this difference is pertinent to considering how beginning instruction in Internet navigation, reading, and writing in earlier grades, such as grades 4 and 5, might be more conducive to developing students' Internet skills, because preadolescents may be more likely than adolescents to turn to teachers and parents for guidance and help. Further, preadolescents may have not yet developed their own Internet practices that might interfere with productive searches and the sharing of online information, as Colwell et al. found in their study.

Relatedly, students in this study were not highly skilled at gathering information from images. Yet, students reported watching videos online as a frequent out-of-school activity. Together, these findings indicate the importance of helping students become informed and critical consumers of images and videos, given the frequency with which students encounter them. These skills are now included in the Common Core State Standards (i.e., Reading Anchor Standard 7: "Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words"; NGA Center & CCSSO, 2010, p. 10) but have historically received little attention in the classroom. This particular Standard is a specific way for teachers to bridge out-of-school texting, image sharing and curating, and video production practices with in-school learning goals. Teachers should assess the practices in which students engage on digital devices when not in school, and make explicit connections for students to in-school instructional activities. Building these connections for students will not only strengthen their understanding of how to use digital tools for school purposes but also model the possibilities through demonstration of the relevance of their out-of-school lives to in-school learning. The increasing use of images and videos to communicate messages makes it vital for students to not only interpret and evaluate these messages but also learn to produce effective messages through images and videos, promoting literacy skills that may be used in both in- and out-of-school settings.

Male Versus Female Use of Digital Tools

A consistent finding throughout our data analysis was that of male and female differences in preadolescents' survey responses to how they used digital tools. There is previous evidence that print-based reading activities and preferences fall along gendered lines. For example, scholars have found differences among students' reading choices based on gender (Benton, 1995), have classified boys as reluctant readers (Sarroub & Pernicek, 2016), and have reported that girls read more than boys do globally (Organisation for Economic Co-operation and Development & United Nations Educational, Scientific and Cultural Organization, 2003). These gendered identities seem to persist in digital spaces also. Thus, findings from the current study indicate a need to understand further how literacy identities are developed in digital spaces and the role that gender plays in the development of those identities.

In the current study, males reported watching online videos, creating videos, and reading fanfiction significantly more than females did both in and out of school. Seemingly, males engaged in more types of digital activities than did females in and out of school, and the activities they engaged in were, on some level, thought-provoking when considering relevant existing research. For example, much research regarding fanfiction participation among adolescents has focused on females (see, e.g., Chandler-Olcott & Mahar, 2003; Thomas, 2006), as female adolescents typically participate in fanfiction reading and writing more than males (Sendlor, 2010). Yet, preadolescent girls' survey responses in the present study indicated that they engaged in fanfiction reading and writing at a lower frequency than most of the other digital activities surveyed, and participated in these types of digital activities at significantly lower frequencies than boys, both in and out of school. These findings raise questions regarding the uptick in female fanfiction participation as adolescents, as they surpass male adolescents' participation.

As preadolescents, females in this study reported that they engaged in more school-associated tasks, even in out-of-school settings, more frequently than males, as females only created multimedia presentations and documents at a higher frequency than males. Male use seemed more heavily linked to digital activities that required the Internet. At the upper elementary grade levels, these types of activities may reflect parenting and

teaching styles more accurately than genuine student interest. Nevertheless, our findings also consider student preference, and these preferences offer insight into the types of digital activities in which preadolescents engage.

Females reported that they preferred and thought it was easier to learn more from reading a book than watching television. Further, they thought they would learn more from reading a book rather than using the Internet, whereas males would rather watch television than read a book for preference, ease, and learning. Males seemingly engaged in digital activities that were more visually and graphically oriented and that required the Internet, whereas females engaged in activities that were more traditional in their use of prose and traditional text. Although fanfiction is often prose based, it can also include graphic representations of text, which may account for males' more significant participation. However, this specification was not included in the survey, so we cannot draw a definitive conclusion. Yet, all other activities in which males engaged more frequently than females, both in and out of school, were graphically oriented, perhaps because of males' personal and learning preferences. Thus, these preferences can be considered in designing learning activities that are likely to be of high interest to students.

These findings may also link males' perceptions that they are more skilled at searching for information online and telling someone about what they found on the Internet, as opposed to females' indication of self-perceived strengths in typing homework assignments. Regardless of gender discrepancies, it should be noted that students overwhelmingly reported that they would learn more from reading a book than reading or viewing any other source, indicating the authority that books are given in upper elementary grades. This finding indicates a need to help preadolescents see both nondigital and digital sources of information as authoritative and to encourage them to critically evaluate and challenge the authority of not only digital texts but also print-based texts.

When comparing males and females, males indicated a willingness over females to engage in online activity that required searching for information or reading information from sources that may not be as authoritative as books are traditionally perceived, indicating male comfort in searching for and finding answers online and consuming information in less traditional ways. However, it is also important to note that despite males' confidence in their abilities, their average digital skills score, which serves as an indicator of online searching and reading skills, was significantly lower than that of females. In other words, although males more frequently perceived themselves as skilled at searching for information online than did females, results of the digital tasks indicate that females in this study were more skilled at searching for and communicating information online, which varies from previous studies that found little significant difference between adolescent males' and females' computer skills (Bunz et al., 2007; Hakkarainen et al., 2000; Koch et al., 2008).

This finding is particularly concerning when considered in light of Hill, Corbett, and St. Rose's (2010) finding that girls hold themselves to higher standards in STEM-related subjects and assess their abilities as lower than boys', even when the girls have good grades and test scores. One result of this self-perception is that fewer girls pursue careers in STEM fields (Hill et al., 2010). The same phenomenon was seemingly true in the current study because girls perceived themselves as less skilled at reading activities involving technology. Indeed, the current study points to the need for continued attention to the equitable treatment of males and females in the classroom and to the types of opportunities they receive. Hill et al. argued that teachers and parents can support girls in and out of the classroom by encouraging them to assess their skills more accurately. In doing so, girls may view themselves as more capable users of technology and be more likely to pursue activities involving technology, which may in turn increase their skills and interest in a variety of topics and subjects.

Teachers can support both males and females by resisting a deficit-laden view in which they perceive boys as reluctant readers and girls as less technologically savvy. Rather, teachers can recognize that digital technology may serve as an entry point to get boys interested in reading and can leverage digital tools to engage and motivate both males and females. Teachers can also ensure that girls see positive models of females engaging with technology competently and encourage girls to explore digital tools in collaborative and noncompetitive ways. Teachers should also resist the view that because computer-related fields have typically been male dominated, males are more skilled with technology and may not need as much instruction as females. By becoming aware of potentially unnoticed differences among males and females, as well as potential opportunities offered by digital technology, teachers can design their classroom instruction to support students of both genders in developing essential skills and a lifelong interest in reading.

Connecting Digital and Nondigital Literacy Practices

Although this study primarily focused on preadolescents' online practices, students in this study were also queried on their print use to consider connections between the two types of literacy practices. Given the

additional complexity of reading online (Coiro, 2011), as compared with reading print-based text, the finding that preadolescent students in this study perceived that it is more difficult to use the Internet than read a book highlights the need for increased attention to instruction that supports preadolescent students' abilities to read, write, and communicate online in addition to print-based reading instruction. Further, and related to the previous discussion of male versus female findings, more males than females indicated that it would be more difficult to read a book than to use the Internet, and more females indicated that they would rather read a book than use the Internet. Both online and offline reading are important modes of reading that are critical for students to master to be literate in the 21st century. Therefore, it is important to provide instruction for students that will address these particular issues and build all students' confidence in their abilities in both modes of reading.

Students in the current study demonstrated an understanding of the need to combine digital and nondigital tools to achieve a desired result, prompting reflection on how print-based, or nondigital, and digital literacy skills can not only be supported through instruction but also be taught in conjunction with each other. This understanding is important and consistent with the goals related to technology use that are presented in the Common Core State Standards (NGA Center & CCSSO, 2010). For example, a description of the Standards in the Common Core document states the following in regards to the vision for student technology use:

> [Students] tailor their searches online to acquire useful information efficiently, and they integrate what they learn using technology with what they learn offline. They are familiar with the strengths and limitations of various technological tools and mediums and can select and use those best suited to their communication goals. (p. 7)

Given the variety and ubiquity of digital tools and tasks that can be completed with those tools, it is imperative that students are able to determine when and how to effectively combine digital tools and resources with nondigital resources.

Similarly, it also important for teachers to discern when it is most effective to integrate digital technology into instruction or when digital technology may actually detract from instruction. Teachers can consider appropriate and effective uses of technology in literacy instruction by using an approach such as Hutchison and Woodward's (2014b) Technology Integration Planning Cycle for Literacy and Language Arts. This planning cycle was designed to encourage teachers to determine their instructional goal before selecting the digital tool they will use and to then determine how the digital tool could enhance or inhibit instruction. It also guides teachers to consider whether and how digital tools should be combined with nondigital tools to be maximally effective. These facets of instructional planning are important for teachers to consider as they integrate digital technology to support students' literacy development.

Limitations

We note here that although this study provides a broad picture of a large population of preadolescents' perspectives and uses of digital technology, it only provides one lens through which to consider these perspectives and uses. Quantitative survey data were the sole data source, and triangulation using other sources of data, such as member checks, was not possible. Therefore, assumptions and connections were made based on the singular source of data. Nevertheless, this study offers one insightful interpretation and analysis of these preadolescents' perspectives of digital technology and how they use such technology in both in- and out-of-school settings.

Further, although this study provides a rich understanding of students in a predominantly white and socioeconomically stable school district, it is important to examine how students in different contexts might respond differently to the survey. Although the gap in access to digital devices continues to decrease, there are still differences in access among different racial and ethnic groups (Anderson, 2015), which would likely influence students' preferences and activities online.

Finally, it is important to recognize that the findings presented here should be interpreted in light of the rapidly changing nature of digital technology. Because of the frequency with which new technologies emerge, studies such as this one should be conducted and updated often.

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Supporting Information

Additional supporting information may be found in the online version of this article:

- Appendix: Survey Items Assessing Students' Digital Skills