

Digital Writing and Production Strategies and Perceptions

Katherine Baleja, Ed.D
Wayne State University
kbaleja@wayne.edu

Mingyuan Zhang, Ph.D
Central Michigan University
Zhang1m@cmich.edu

Abstract

Digital writing is an important aspect of K-12 education. Students must be able to create and compose digital material as they collaborate and share experiences with others, both inside and outside school walls. As educators are required to teach reading and writing, literacy must become digital to keep pace with a technology-centered society. As scholars continue to struggle to define digital literacy, determining what to teach fluctuates greatly from one classroom to the next. While research is abundant pertaining to digital literacy, past studies concentrated on specific tools or resources. Focusing on digital writing strategies, technologies, and perceptions this mixed-method study surveyed educators in Michigan about digital writing practices. Overall educators feel teaching digital literacy is important, but lack professional development to support and sustain successful implementation. Many educators are still unsure what digital literacy entails, and therefore struggle to teach the concepts.

Keywords: Digital Literacy, Educational Technology, Digital Writing, Teaching Strategies

Writing has always involved some form of technology, from impressions in wood or stone, to pen on paper, to fingers on a keyboard or touchscreen. Technology has changed how we write and compose to often include images, audio, and video. It has forced educators to revisit how they teach students, not only focusing on how to consume information but just as important, how to produce across various types of media. With our current technology, writers now reach a much wider and more varied audience than ever before.

With the medium in which writing is presented changing, students need to improve their writing skills. From a survey where Advanced Placement (AP) and National Writing Project (NWP) teachers rated their students' digital writing skills, at least one-third to two-thirds of the students were rated as fair or poor in each category (Purcell, Buchanan, & Friedrich, 2013). What does that say about our students and their digital writing skills? Now, more than ever, as written content reaches further, all students must learn how to be proficient digital writers.

The focus of digital literacy research has often centered on receiving content and evaluating information. Past research with digital writing and creation often included studies with children presenting their work with limited forms of technology, or from teacher created templates. Research on digital writing is beginning to include examples of students creating websites and reaching a wider audience (Buckingham, 2006), but research suggests a problematic lack of education related to digital literacy (Jones-Kavalier & Flannigan, 2006). While digital writing has been recognized with the increase of online publishing (Beeson, 2006), there is still a great deal of knowledge to be gained about digital writing and creation, as scholars still do not agree on the specific proficiencies required to master digital literacy (Hicks, Baleja, & Zhang, 2019).

Most often, research on digital writing is embedded in studies on overall digital literacy. Given the relatively new occurrence of multimodal composing in schools, most reviews of digital writing have focused on technologies that have been around for a while (Dalton, 2012). While using social media as a writing tool is a common topic, there has been limited published research on the use of social media for writing development with K-12 students (Zheng, Warschauer, & Farkas, 2013). Further studies may list digital writing, but often reference digital literacy in general, offering little insight about digital writing trends and strategies. Many studies focus on adult learners or non-school settings for digital writing, while some studies have looked at the relationship between one-to-one laptop programs and the writing process.

While information is available on perceptions of digital literacy, samples generally target certain content areas or grade levels. Little research looks specifically at educator perceptions and beliefs of digital writing across all grades and content areas. Very little research takes a comprehensive look at the frequency of digital writing that is occurring in the classroom, along with corresponding strategies and resources. This research aims to gather information in these areas where knowledge is lacking.

This research is part of an ongoing international agenda to understand how to teach digital literacies in the classroom. Digital writing is an essential skill all students must learn, regardless of content area or curriculum platform. The respondents from this study had teaching experience from one to forty-five years, covered nearly all subject areas, and came from districts ranging from approximately one hundred total students to those with over ten thousand students. By understanding how educators approach digital writing, and their perceptions of its effectiveness, the strategies for incorporating digital writing into K-12 education will be improved. With the

focus of this study centering on digital writing with K-12 educators, the target audience would include primary and secondary teachers, administrators, and literacy and technology coaches.

The purpose of this study is to understand how educators integrate digital writing strategies into their lessons, as well as best practices for future lessons. Knowledge will be gained regarding use of digital writing strategies, along with a clearer understanding of the thought process for choosing appropriate strategies and a stronger picture of what educators define as digital literacy.

Research questions that this study will address include:

1. What are educators' perceptions of digital writing?
2. Is there a difference in the educators' beliefs of digital writing between gender, grade levels, or years of service?
3. How do educators incorporate digital writing into their lessons?
4. What technologies do educators use to teach or demonstrate digital writing?

Literature Review

Technology has changed how our current students interact with writing. The Common Core curriculum requires all K-12 educators to teach reading and writing (Common Core State Standards Initiative, 2015). While not always explicitly stated in the Common Core, technology plays a role in literacy. As states and nations have adopted other curriculum, the importance of digital writing skills remains the same. As technology becomes more apparent in students' everyday lives, it has become necessary to look at the impact it has on literacy. While some schools are transitioning to one-to-one with laptops and tablets or allowing students to bring in their own devices, consistent technology use in lessons is still lacking. As technology continues

to insert itself into our education system, its impact on literacy, specifically producing content, it still unclear.

What is Digital Literacy?

The term digital literacy has undergone many changes in identity. Since Gilster (1997) first made the world aware of the concept of digital literacy in the late 1990s, many relating terms have emerged: computer or ICT literacy, information literacy, new literacies, multiliteracies, multimodal texts, media literacies, digital competence, e-literacy, e-skills, and eCompetence (Gallardo-Echenique, Oliveira, Marques-Molias, & Esteve-Mon, 2015).

Gilster (1997) described digital literacy as “having a specific set of information skills (e.g., evaluation, searching) applied to text and multimedia information found on the Internet and situated in a formal, school-based learning context” (as cited in Meyers, Erickson, & Small, 2013, p. 355). With technology and the Internet constantly changing, digital literacy is expanding to include a broader concept of more than words and language (Greene, Yu, & Copeland, 2014; Mohammadyari & Singh, 2015), requiring skills to express, create, share, interact, and emerge (Meyers, Erickson, & Small, 2013). Green, Yu, and Copeland (2014) note how the “current definitions of digital literacy do not sufficiently emphasize the essential cognitive and metacognitive processes needed to learn effectively from multiple representations of content” (p. 56). A fluid definition of digital literacy is necessary because of the constant changes and developments with the Internet and technology (Meyers, Erickson, & Small, 2013). As part of their research, Hall, Atkins and Fraser (2014) created a working definition of digital literacy:

Digital Literacy refers to the skills, attitudes and knowledge required by educators to support learning in a digitally-rich world. To be digitally literate, educators must be able

to utilize technology to enhance and transform classroom practices, and to enrich their own professional development and identity. The digitally literate educator will be able to think critically about why, how and when technology supplements learning and teaching (p. 5).

Students must be able to successfully work with multimedia texts to gain 21st century skills (Marsh, Hannon, Lewis, & Ritchie, 2015). “Digital literacy is the ability to access, search, evaluate, modify and distribute digital media, and develop skills in the use of new technologies” (Mohammadyari & Singh, 2015, p. 12). As literacy changes to include various media forms, we need to reevaluate how we teach literacy (Colwell, Hunt-Barron, & Reinking, 2013). It can be difficult to manage and implement digital literacy with the constant and rapid changes of the Internet and technology. As our education system continues to evolve and embrace digital literacy, educators need a better understanding of how to prepare students to be literate in a digital world.

Digital Writing and Our Current Students

As technology continues to advance and be more readily available, it has become common among our student population, questioning whether our current students who grew up with technology learn differently compared to past generations (Bennett, Maton, & Kervin, 2008). Our current children are immersed in technology and media from early on (Marsh, Hannon, Lewis, & Ritchie, 2015). Although these students may have grown up with technology and can multitask, it should not be assumed that they possess all the necessary technical skills to be successful, particularly when writing digitally. While students may be familiar with technology, Bennett, Maton, and Kervin (2008) discovered that “only 21% of students were engaged in creating their own multimedia for the web” (p. 778).

Experience and circumstantial factors impact how digital skills are taught. While the concern for the digital divide and having access to technology is still important, we must also look at the degree to which people are successful with technology (Horrigan, 2016), shifting our attention to the activities children and young people digitally engage in, and the digital practices that coincide (Gallagher, Di Cesare, & Rowsell, 2019). A vast majority of teens have embraced written communication through social media, instant messages, and emails. Despite the rise in technology use, there is a disconnect between out-of-school and in-school digital writing practices (Zheng, Warschauer, & Farkas, 2013). While most teens compose some form of digital text, very few view their emails, text messages, or social media posts as real writing, and both parents and teens feel there is a greater need to write well today than ever before (Lenhart, Arafeh, Smith, & Macgill, 2008).

Despite the continuous recommendations that students write lengthy pieces, do projects with research and analysis, and write across the curriculum, many teens state how their assignments are mostly short, do not include research, and are generally in English and language arts classes (Lenhart, Arafeh, Smith, & Macgill, 2008). In a survey done by the Pew Research Center, more than ninety percent of teens expressed writing short assignments, taking notes, or writing essays for school. While about seventy percent of these students have spent time with at least one assignment on digital writing in the form of audio, video, or multimedia presentations, only ten percent have written for computer programs (Lenhart, Arafeh, Smith, & Macgill, 2008). Current teens feel that additional writing time in class and using computer-based writing tools could help improve their abilities (Lenhart, Arafeh, Smith, & Macgill, 2008).

A survey of AP and NWP teachers rated their students' writing skills in various categories. More than half the teachers rated their students as fair or poor for giving constructive

feedback on other students' work, appropriately citing content, synthesizing content from multiple sources, using appropriate tone and style, and constructing a strong argument, with nearly two-thirds of the teachers rating their students fair or poor with reading and digesting complex texts and navigating copyright (Purcell, Buchanan, & Friedrich, 2013). While our students may know how to navigate technology, they still need assistance when writing for a purpose.

Digital Writing Strategies

Technology offers many new avenues to aid with digital writing. One advantage of utilizing technology for digital writing is the support it can offer in providing feedback to students. Automated Writing Evaluation (AWE) programs can help ease the burden of time, often required in providing feedback (Zheng, Warschauer, & Farkas, 2013). Digital tools that offer interactive feedback can also help students be more receptive to improving their writing (Purcell, Buchanan, & Friedrich, 2013). Writing and editing are the principal purposes of laptops in many one-to-one programs (Zheng, Warschauer, & Farkas, 2013). In laptop classrooms, students receive more feedback on their writing, edit their papers more often, utilize a wider range of resources, and publish or share their work more often. (Grimes & Warschauer, 2008; Lei & Zhao, 2008).

One of the biggest impacts of mobile devices on digital writing comes from how communication occurs. Mobile devices open up an endless supply of tools to share experiences with others. Students can publish work online in a variety of formats through blogs and websites. Students also have the ability to instantaneously share thoughts and experiences live, or create content and share at a later date (Yang, 2014). Sharples (2002) stressed how learning should be conversational, and that mobile technology can provide a pathway to accomplish this. In the past,

conversations for learning took place in person. Mobile technology allows learning to expand, offering a greater range of learners that can interact and share information. Learning is no longer bound by the walls of the classroom or school hours.

An essential part of digital literacy comes through online communications that allow learners to interact with peers and instructors, synchronously and asynchronously, in ways that extend beyond the classroom (Ellison & Wu, 2008). To improve communication skills, students need to practice navigating the Internet, especially as some researchers have linked digital literacy with search literacy (Greene, Yu, & Copeland, 2014). Email is one of the most widely used digital writing tools. Email offers direct communication, sending in a manner of seconds. It is easily accessible on a multitude of devices and links with other electronic texts, including hyperlinks and attachments.

While the Internet is a main source of research for writing assignments, most teens reported primarily writing by hand (Lenhart, Arafeh, Smith, & Macgill, 2008). While computers may offer speed and neatness with editing, many felt it is easier to organize thoughts on paper than a computer. While many students are familiar with researching online, accessing or downloading an assignment, or submitting assignments online, few publish their work for others outside of the class to view, edit or give feedback using collaborative tools, or participate in online discussions (Purcell, Buchanan, & Friedrich, 2013).

Despite concerns, some teachers have embraced social media with digital writing. One teacher explains how participating in scheduled Twitter threads helped students interact with authors of books they were reading (Purcell, Buchanan, & Friedrich, 2013). Social media can also provide students with mentors, particularly when working on a new or unfamiliar topic (Purcell, Buchanan, & Friedrich, 2013).

Blogging is one strategy where students can write digitally both for personal and educational uses. Students can extend their learning opportunities through blogs and gain perspectives from others beyond their classroom by first collecting, editing, and assessing their work and then publishing for a virtual audience (Kennedy, 2003). Students explained that writing a blog page allows for more expression and voice than simply writing a standard essay (Ellison & Wu, 2008). Students have also expressed negative concerns writing online. Some students are not comfortable sharing their thoughts with others in an open setting, such as a blog, while others feel they are not provided substantive feedback in this setting (Ellison & Wu, 2008). There is evidence that teachers face a wide range of obstacles integrating digital literacy into their teaching (Colwell, Hunt-Barron, & Reinking, 2013). By learning more about how educators implement digital writing strategies, such as blogs, we can engage our students and improve their digital literacy skills.

Digital storytelling has become a popular choice with digital writing as there are numerous tools and resources (Sylvester & Greenidge, 2009). The multimedia approach of digital storytelling takes students through the writing process while adding complementing images, sounds, and videos. Teachers are also looking at collaborative tools for digital writing. Websites and apps like Google Docs offer a place for students to compose together and provide feedback in real time (Purcell, Buchanan, & Friedrich, 2013).

Because of the growing concern for understanding fair use and copyright, along with appropriately citing and referencing content, many teachers focus on these areas with digital writing (Purcell, Buchanan, & Friedrich, 2013). Websites like Turnitin.com are often utilized as a way to help prevent plagiarism, as well as check grammar, peer edit, and view previous work. As technology continues to advance, educators must maintain strategies that can evolve with the

changing technology. While research suggests there are many ways to use technology with digital writing, are these resources being utilized, and if so, how often? What are educators doing to prepare students to create, collaborate, and communicate through these new digital avenues?

Digital Writing Difficulties

Technology offers many opportunities for digital writing, but there are also many challenges. While the vastness of the Internet broadens the audience and reach for students sharing their writing, concern exists with informal styles from social media and text messaging sneaking into more formal writing tasks (Lenhart, Arafeh, Smith, & Macgill, 2008). The lines between formal and informal writing continually increase in ambiguity. As technology expands the reach of student publications, students must be educated on writing for different audiences and using different voices (Purcell, Buchanan, & Friedrich, 2013). Access to digital tools and wide varying skill levels among students also proposes many issues. Teachers have noted the challenge of shifting students' perceptions of digital technologies from toys to learning tools (Purcell, Buchanan, & Friedrich, 2013).

Lack of critical thinking skills plays a huge role in difficulties with digital writing. Students become so focused on gathering information quickly, their writing thoughts are often approached in the same manner, speeding through tasks and underestimating the time necessary to produce coherent pieces of writing (Purcell, Buchanan, & Friedrich, 2013). Other teachers struggle with pre-writing assignments, aimed at helping students think through and organize their ideas before jumping in and writing (Purcell, Buchanan, & Friedrich, 2013).

With seventy-three percent of AP and NWP teachers utilizing mobile technology and with BYOD being noted as a good alternative to decreasing budgets, there is still quite often the view that mobile devices be banned in the classroom (Purcell, Buchanan, & Friedrich, 2013). The

challenge is finding ways to integrate technologies that are seamlessly integrated rather than viewed as additional requirements.

As trends for technology inclusion continue to grow in education, many teachers still struggle to effectively integrate digital literacy skills (Hutchison, Beschorner, & Schmidt-Crawford, 2012). While attitudes are generally positive toward technology, educator courses offer insufficient modeling of technology integration (Husbye & Elsener, 2013), and research suggests a lack of education related to digital literacy (Jones-Kavalier & Flannigan, 2006). Colwell, Hunt-Barron, & Reinkng (2013) describe problems with appropriate professional development and planning time to develop lessons and activities. While there are successful cases of educators integrating digital literacy, these often occur in small pockets due to lack of ongoing professional training and support (Jones-Kavalier & Flannigan, 2006). All these issues impact how teachers integrate technology and writing into the classroom.

Methods

Study Design

In order to collect and analyze both quantitative and qualitative data in a single study, a mixed-method approach was chosen (Creswell J. W., 2015). The mixed-method design allowed for a more comprehensive look at the research problems than using either type separately.

Utilizing a convergent parallel mixed method approach allowed for both quantitative and qualitative data to be collected simultaneously to understand the research problems (Creswell J. W., 2014).

Using Qualtrics, an Internet survey instrument, a cross-sectional survey was conducted to allow for a comparison of several different variables all at the same point in time. The purpose of the survey was to gather information about K-12 educators and the strategies they use to implement digital literacy into their curriculum, specifically looking at teaching digital reading and writing. Information was also collected about technology resources that were used during digital reading and writing activities and the frequency of use. Rather than focusing on specific apps or websites, the strategies listed in the survey concentrated on general uses. Open-ended responses on resources and examples of strategies that are used directly or indirectly to teach digital literacy were also part of the survey.

Sample and Procedures

K-12 educators in Michigan were the focus of this survey. The survey was first distributed to district superintendents and principals of K-12 schools in Michigan, who in turn dispersed the survey to their teaching staff. Utilizing staff emails on district websites, the survey was also directly emailed to K-12 teachers. A description of the project and an offer to participate in the survey was provided through a link embedded in the invitation. A follow-up email with a

link to the survey was sent after the first week as a reminder to those participants who did not initially respond.

The sample included 174 participants from Michigan public schools with teaching experience ranging from one to forty-five years. The breakdown of respondents by content was as follows: twenty-six percent taught mainly ELA or reading, seventeen percent mostly taught mathematics, seven percent taught social studies, fifteen percent taught in the sciences, and thirty-five percent mainly taught other subjects or taught all subjects equally. A wide range of district sizes were represented from approximately one hundred total students to those with over ten thousand students. The four open-ended questions were answered by ninety-three of the participants. These responses offered additional details on examples of digital literacy, along with strategies and resources.

Research Procedure and Instruments

The Internet survey instrument Qualtrics was utilized for the questionnaire. Research questions were keyed into the survey tool account. Participants were emailed an invitation to respond to the survey with a link embedded in the email and were asked to respond to the survey within two weeks. As a reminder to complete the survey, a follow-up email was sent a week before the survey ended.

This survey was designed using the framework from the Pew Internet Survey on digital tools and writing (Purcell, Buchanan, & Friedrich, 2013) and the Teacher Technology Survey (Center for Technology Implementation, 2013). Opinions from experts in the digital literacy field were also used in creating this survey. A pilot study was performed to improve the validity of the survey.

The survey was designed into sections. The first section included demographic information about each participant. The second section focused on available technology resources and perceptions of teaching digital literacy. The last section included information on the frequency of technology use for digital writing (Table 1), types of strategies and resources used for digital writing along with their frequency (Table 2), and open-ended questions. The response questions gave the participants the opportunity to expand upon previous questions about digital writing strategies and resources. The full survey can be found in Appendix A.

Table 1: Survey Item #18

How often do students utilize technology for digital WRITING in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
One-to-One School					
Student Provided					
Cell phone/smartphone					
Computer Lab					
Laptops					
Tablets					
Other					

Table 2: Survey Item #20

How often do students utilize the following resources for digital WRITING in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
Reading Apps/websites					
Search Tools/Research					
Learning Management System					
Audio Recordings					
Graphic Organizers/Interactive Posters					
Presentations					
Screencasting					
Formative Assessment					

Writing/Typing					
Communication					
Annotations					
Social Media					

Anonymity was maintained for all participants, as the survey instrument did not track IP addresses or other identifying information. Participants were informed that was not any foreseen harm to their personal or mental health. Participation was voluntary and educators received no compensation for their participation.

Data from completed surveys were imported from Qualtrics into SPSS for analysis. The research questions were analyzed utilizing frequency tests, One-way ANOVA tests and factorial ANOVA tests. Frequency distributions provide the number of occurrences and the percentage. ANOVA, or analysis of variance, analyze the differences among group means in a sample (Cronk, 2014). A one-way ANOVA determines whether there are any statically significant differences with one independent variable, while a factorial ANOVA has two or more independent variables.

Open-ended questions were coded with Nvivo, a qualitative data analysis software, focusing first on strategies that involved digital writing and looking for common patterns and phrases. An inductive coding method was utilized in breaking down the data into smaller samples. Coding also looked at the type of resource utilized, along with examples and difficulties with digital literacy, focusing on patterns and common themes related to digital writing. Responses from the qualitative questions were used to support data from the quantitative questions and further insight about strategies educators utilized.

Results

1. What are educators' perceptions of digital writing?

Seventy percent of the educators felt they teach digital literacy. Seventy-eight percent agree or strongly agree that teaching digital writing is important, yet only twenty-three percent felt they had enough professional development in teaching digital writing. Only thirty-seven percent of the teachers expressed feeling comfortable teaching digital writing (Table 3).

Table 3: Frequency of Digital Writing Beliefs

Survey Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10. Do you feel you teach digital literacy in the classroom?	19.5% (34)	50.6% (88)	16.7% (29)	10.9% (19)	1.7% (3)
14. I feel teaching digital WRITING is important	27.0% (47)	50.6% (88)	16.1% (28)	4.0% (7)	0.6% (1)
15. I have had enough professional training in teaching digital WRITING	8.6% (15)	14.4% (25)	25.3% (44)	40.2% (70)	10.3% (18)
16. I am comfortable teaching digital WRITING	11.5% (20)	25.9% (45)	28.2% (49)	27.6% (48)	5.7% (10)

2. Is there a difference in the educators' beliefs of digital reading between gender, grade levels, or years of service?

New variables were created from the survey data to test the research question. The first new variable was created by combining the four digital writing perception survey items (Table 4). The second new variable was created by separating the grades taught into four categories: lower elementary (PreK-2nd), upper elementary (3rd-5th), middle school (6th-8th), and high school (9th-12th). The third new variable was created by breaking the years an educator taught into five categories: 0-5 years, 6-10 years, 11-15 years, 16-20 years, and 21+ years.

Table 4: Survey Questions Combined to Make New Belief Variable.

#	Question
10	Do you feel you teach digital literacy in the classroom?

	a. Strongly agree b. Agree c. Neutral d. Disagree e. Strongly disagree
14	I feel teaching digital WRITING is important
	a. Strongly agree b. Agree c. Neutral d. Disagree e. Strongly disagree
15	I have had enough professional training in teaching digital WRITING
	a. Strongly agree b. Agree c. Neutral d. Disagree e. Strongly disagree
16	I am comfortable teaching digital WRITING
	a. Strongly agree b. Agree c. Neutral d. Disagree e. Strongly disagree

A 2 (gender) x 4 (grade levels) x 5 (years of service) between-subjects factorial ANOVA was calculated comparing the participants' beliefs of digital writing (Table 5). The main effect for gender was not significant ($F(1,100) = 2.92, p > .05$). The main effect for grade levels was not significant ($F(3,100) = .52, p > .05$). The main effect for years of service was not significant ($F(4,100) = .44, p > .05$). The gender-grade level interaction was not significant ($F(2,100) = 1.56, p > .05$). The gender-years of service interaction was not significant ($F(4,100) = 1.03, p > .05$). The grade level-years of service interaction was not significant ($F(12,100) = 1.20, p > .05$). Finally, the gender-grade level-years of service interaction was not significant ($F(3,100) = .86, p > .05$).

Table 5: Factorial ANOVA Comparing Participants' Beliefs

Tests of Between-Subjects Effects

Dependent Variable: WritingBeliefs

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	296.497 ^a	29	10.224	.997	.483
Intercept	5413.073	1	5413.073	527.624	.000
Gender	29.969	1	29.969	2.921	.091
GradeLevelGroups	15.946	3	5.315	.518	.671
YearsOfServiceGroup	17.966	4	4.491	.438	.781
Gender * GradeLevelGroups	31.980	2	15.990	1.559	.216
Gender * YearsOfServiceGroup	42.411	4	10.603	1.033	.394
GradeLevelGroups * YearsOfServiceGroup	147.596	12	12.300	1.199	.294
Gender * GradeLevelGroups * YearsOfServiceGroup	26.487	3	8.829	.861	.464
Error	1025.934	100	10.259		
Total	15592.000	130			
Corrected Total	1322.431	129			

a. R Squared = .224 (Adjusted R Squared = -.001)

3. How do educators incorporate digital writing into their lessons?

Educators utilized learning management systems such as Google Classroom or Schoology and writing tools like Word or Google Docs the most as a way to incorporate digital writing into their lessons (Table 6). Forty percent of the teachers used a learning management system to teach digital writing at least a few times a week or more, and thirty-nine percent utilized writing tools. Communications such as email were the next highest utilized way of incorporating digital writing with twenty-nine percent, followed by researching/search tools with twenty-three percent.

Screencasting was the least utilized resource with ninety percent rarely or never using it for digital writing. Social media, graphic organizers, digital portfolios, and audio recordings were

the next least utilized resources with eighty-seven, eighty-five, eighty-four, and eighty-three percent respectively rarely or never using the tool for digital writing. Also notable, annotations were rarely or never used by seventy-six percent, presentations sixty-eight percent, spelling and grammar resources sixty-seven percent, typing sixty-six percent, and editing and feedback along with formative assessment each with sixty-two percent. Educators who frequently used one resource were more likely to use multiple resources to teach digital writing.

Table 6: Frequency of Digital Writing Resources

	Everyday	Weekly	Few times a month	Rarely	Never / NA
Learning Management System	19.5%	20.1%	15.5%	6.3%	38.5%
Writing	10.3%	28.2%	17.8%	10.3%	33.3%
Communication	8.6%	20.7%	13.8%	13.8%	43.1%
Search Tools/Research	5.7%	17.2%	27.6%	13.8%	35.6%
Typing	8.0%	12.6%	13.8%	12.1%	53.4%
Spelling/ Grammar	6.3%	13.2%	13.2%	15.5%	51.7%
Formative Assessment	0.6%	17.2%	20.7%	16.1%	45.4%
Editing/ Feedback	1.7%	12.1%	24.7%	20.7%	40.8%
Annotations	0.6%	11.5%	12.1%	19.5%	56.3%
Presentations	1.1%	6.9%	23.6%	19.5%	48.9%
Social Media	2.9%	4.6%	5.7%	17.8%	69.0%
Digital Portfolio	2.3%	4.0%	9.2%	19.5%	64.9%
Graphic Organizers/ Interactive Posters	0.0%	5.2%	10.3%	23.6%	60.9%
Audio Recordings	0.0%	4.6%	12.1%	26.4%	56.9%
Screencasting	0.0%	2.3%	8.0%	23.0%	66.7%

When comparing resources for digital writing used by grade levels (lower elementary, upper elementary, middle school, and high school) significant differences were found when calculating a one-way ANOVA between those who taught lower elementary and those who taught middle and/or high school (Appendix B). Tukey's HSD was used to determine the nature of the differences between the grade levels. Middle and high school teachers were more likely to use the following resources than lower elementary teachers: editing/feedback, search tools/research, learning management systems, digital stories/presentations, podcasts/screencasts, formative assessment, writing, communication, note-taking/annotations, social media/blogging, and spelling/grammar.

When comparing resources for digital writing used by content (English, mathematics, science, social studies, or other) significant differences were found when calculating a one-way ANOVA between those who taught English and those who taught mathematics (Appendix C). Tukey's HSD was used to determine the nature of the differences between the subjects. English teachers were more likely to use the following resources than mathematics teachers: editing/feedback, search tools/research, and writing. No significant differences were found among years of service or district size and digital writing resources.

4. What technologies do educators use to teach or demonstrate digital writing?

More than half (54%) of the respondents work at a school with one-to-one technology (Table 7), but only twenty-three percent used it weekly or daily for digital writing (Table 8). Personal devices such as laptops or tablets were only used by students from eleven percent of the teachers for digital writing. While thirty-five percent of the educators allow students to use their

cell phones and smartphones in class, only nine percent have students use the device for digital writing at least a few times a month. School computer labs are available to sixty-six percent of the teachers, and fifty-six percent have access to school laptops. Only five percent of these teachers use the computer lab for digital writing activities on a regular weekly or daily basis, with only fifteen percent use the computer lab for digital writing a few times a month. Those with access to one-to-one technology were less like to use other methods of technology for digital writing.

Table 7: Technology Access

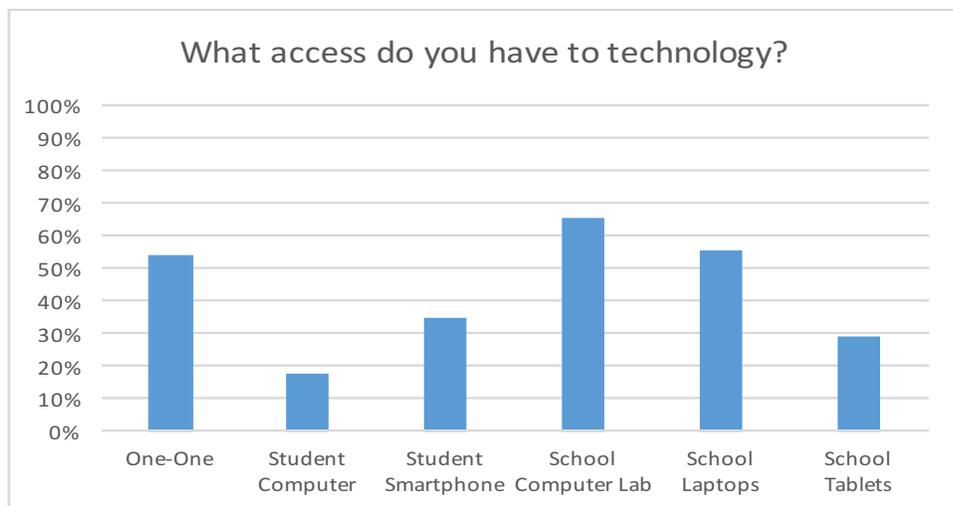


Table 8: Technology Frequency for Digital Writing

How often do students utilize the following resources for digital WRITING?					
	Everyday	Weekly	Few times a month	Rarely	Never / NA
School One-to-one	9.2%	13.8%	12.1%	9.8%	55.2%
Student Computer	0.6%	5.2%	5.2%	12.6%	76.4%
Student Smartphone	1.7%	3.4%	4%	10.3%	80.5%

Computer Lab	1.1%	3.4%	14.9%	6.1%	64.4%
School Laptops	1.7%	6.3%	13.8%	16.1%	62.1%
School Tablets	1.1%	2.3%	4%	14.4%	78.2%

Discussion

This study emphasizes the ongoing concerns about digital literacy professional development. Just over half (50.5%) the participants disagreed or strongly disagreed that they had enough training with digital writing. Through the open-ended survey questions, this was further reinforced with twenty-one respondents describing professional development as an issue with teaching digital literacy. One educator described their issue with teaching digital literacy as “not knowing enough about it.” Another teacher said, “My knowledge and comfort level prohibit me from teaching digital literacy well.”

Previous studies, such as Jones-Kavalier & Flannigan, (2006) and Colwell, Hunt-Barron, & Reinkng, (2013), have stressed the absence of digital literacy training in the education field and the struggle to implement technology for use with digital literacy. This current study indicates that the struggle with educators having enough training and support with digital literacy is still clearly present. It demonstrates a need for a more in-depth look at what must be done to help rectify this deficit, and help our educators feel more confident to move forward with digital literacy.

Colwell, Hunt-Barron, & Reinkng (2013) noted how past research suggests a wide range of obstacles that often hinder technology integration with literacy instruction. Along with appropriate professional development, hurdles include technical resources and support, time to plan and develop lessons and activities, useful teaching frameworks, and teacher beliefs and preceptions. Twenty-three educators from this study had similar views stating how time was an

issue when trying to teach digital literacy. One educator noted how “I hate grading online assignments. It's more thorough to grade essays on paper (even the students find this to be true).”

A math teacher stated that “given there are so many math standards to teach, I don't take the time to have students do this.” Several educators addressed issues of students being too young and needing extra help and therefore not having the time or resources. One teacher stressed how

“The struggle is that as a teacher, it is still VERY CUMBERSOME and TIME CONSUMING to grade digital literacy projects. The programs are slow to load, the lag time great, and you often can't do what you could with pen and pencil grading. If this process could be streamlined, faster, and all around easier I know many of us would engage in more of it. Currently, even though we are 1 to 1 with student iPad, I still give the written portions of the test as pencil/paper tests.”

From this study, seventy percent of the educators felt they teach digital literacy and seventy-eight percent acknowledged the importance of digital writing. Despite a strong positive belief in digital writing, only thirty-seven percent of the teachers expressed feeling comfortable teaching digital writing. Also noted, while nearly three-quarters of the teachers felt they teach digital literacy, the frequency of using various resources is quite low, with rarely or never using a resource ranging from forty-five to ninety percent. That means at most, just over half of the participants are using some of the resources on a monthly or better basis, and many of the resources were only used monthly by ten percent of the participants. While educators may feel they teach digital writing, the frequency of digital writing activities appears to be quite low.

Marsh, Hannon, Lewis, & Ritchie (2015) noted how while necessary, competence with written texts is no longer sufficient for our students. Students also need to engage successfully with multimedia texts. What Marsh, Hannon, Lewis, & Ritchie (2015) failed to offer were

strategies that would help students acquire these necessary digital literacy skills. Based on the frequency digital writing resources were used, it would appear most educators in this study are not utilizing multimedia texts. Only one educator gave a thorough example of digital literacy and the variety of media the students utilize:

“Students selected a topic to study. They used online resources to research the topic. Students were expected to be able to find multiple sources (8-10) and decide if the sources were credible. They had to read the digital information and comprehend it. Students kept a digital research notebook on Google Docs where they kept their notes from their sources. When they finished researching, they were expected to synthesize the information and create "something new." We had studied many forms of texts throughout the year so students had mentor texts of blogs, vlogs, websites, videos, infographics, Google Slide presentations, podcasts, etc. They were expected to select the form that best matched their information, audience and purpose and create a non-fiction text to share the information they learned through their research.”

As Ellison & Wu’s (2008) work noted the benefits of online communication and collaborative learning, their only strategy was the use of blogs. While responses from this study provided examples of online communication, very few gave examples of collaborative learning. One teacher explained how “the students researched their topic with their devices, cited their sources, typed the paper on Google Docs, and shared their paper with at least 2 other students for comments/feedback.” Other teachers gave examples of online communication explaining how students “read and comment on the articles of their peers,” or “use a discussion board to comment on the successes and failure of their own video and comment on two other students’ comments.”

From the data in this study, social media and blogs were only utilized for digital writing by thirteen percent of the teachers on a monthly or more frequent basis, and only two examples provided in the written responses related to blogs or social media. One of the examples was from an art teacher who stated “We blog about our artwork and the projects we work on in class.” The infrequent use of social media and blogging may indicate a need for more professional development and awareness about the use of social media and blogs for digital writing.

A few previous studies have focused on annotations and note-taking, observing how non-linear annotations can enhance learning outcomes (Hsu, Hwang, & Chang, 2013). Linear reading refers to reading articles from beginning to end sequentially. Non-linear reading emphasizes reading as the learner sees fit, often jumping around based on need. While non-linear reading is increasing with the vast options on the Internet and with hyperlinks, digital writing strategies aimed to assist with this do not appear to be widespread. Only twenty-four percent of the educators in this study used annotations or note-taking with digital writing on a monthly or more frequent basis, and only eight gave examples of annotating in their written responses. One teacher explained how “some students use technology to note-take and share informative pictures or graphics regularly,” while another expressed how “kids are using write up or MetaMoJi notes to annotate, highlight, or take notes on a reading passage.”

Twenty-six of the educators described guided practice and modeling as a strategy used to teach digital literacy. One teacher explained how they “introduce the technology and model it for the students and then monitor them as they use it,” while another described how they use “modeling and teaching how everyday use looks.” With guided practice, one teacher explained “when demonstrating a new skill, I type right alongside my students as they are linked with the electronic. Step by step works best for my students,” while a second described their method as

“guided practice utilizing Google Classroom.” As noted by Yang (2014), students need clear modeling and practice with digital literacy to become independent and be able to use resources for critical thinking.

It is clear from this research that many teachers are still unsure what digital literacy means. Numerous teachers were unable to offer strategies or an example of how digital literacy looks in their classroom, often giving the response of “I don’t think I know what digital literacy is” or “I don’t usually have students create things digitally in class.” Regrettably, many educators view digital literacy as a separate standard or content and not part of the regular curriculum. Several teachers noted how they do not have time to teach digital literacy along with all the curriculum demands. One educator stated how there is “not enough time in the trimester to fit it into the curriculum,” while another noted how “it isn’t in the common core.” Digital literacy, especially digital writing, needs to be viewed as a conduit for learning, not a separate curriculum requirement. Technology allows students to express their learning in a variety of ways.

Like Nelson, Courier, & Joseph (2019), this study shows the majority of educators agreeing on the importance of digital literacy. The disagreement arises with what those skills entail and how they should be taught. Digital texts offer different affordances (Colwell, Hunt-Barron, & Reinkng, 2013; Hutchison, Beschoner, & Schmidt-Crawford, 2012) and therefore require different skills and strategies. With past studies focusing on specific technology tools or instruction, more research is needed with strategies that can be applied across multiple grade levels and content areas. This reinforces the need for ongoing professional development and support with digital writing.

Limitations

Despite the study being sent to superintendents and principals from public schools across the state, many of those emails went to spam and others ended up in junk mail as they were forwarded to the teaching staff. Emails were also sent directly to K-12 teachers across the state for those that were listed on their school's website, but again, these messages may not have been opened or were automatically sorted into junk mail. With the small number of respondents, this study would be stronger with a larger sample.

Although the respondents consisted of a wide range of district sizes, grade levels, and subjects, the population was quite small. To gain a better overall understanding of educators' perceptions of digital writing along with strategies and resources used, further research is necessary. More research with digital writing perceptions and strategies is needed to generalize this information.

Implications and Conclusion

The survey results indicated the followings:

1. Educators agree teaching digital literacy is important, but express concerns about professional development
2. The frequency of digital writing activities does not appear to align with beliefs on importance of digital literacy
3. Educators face technology and time issues when trying to integrate digital literacy, along with unclear ideas of what digital literacy entails
4. There were not any observed differences among gender, grade levels, or years of service with beliefs of digital writing

5. Differences were observed among lower elementary teachers and middle school and high school teachers with strategies and resources used for digital writing
6. Differences were observed between English / Reading teachers and mathematics teachers with resources used for digital writing.

As technology continues to change and advance, continued research is needed in the area of digital literacy. With the technology remaining a focal point in our daily home and work lives, it is evident that digital skills are important and studies on digital writing must continue so we can better understand what skills are essential and how best to teach and assess those skills. Instructors need a better understanding of how technology and literacy can seamlessly be integrated with the current curriculum regardless of grade level or content area. With technology at the center of how we communicate daily, teaching our students how to navigate constantly changing technology resources effectively needs to become a priority in our education system.

Despite the majority of educators believing digital writing is important, professional training is not being offered to support the needs of educators. With the range of skills and understanding of digital writing, educators need training options that can be personalized to their needs. Although some educators provided detailed examples of how digital literacy looks in their classroom, others were completely unsure what digital literacy means or felt there was not enough time to teach it along with required content curriculum. This study emphasized the need for proper training and ongoing support with digital writing, along with a better understanding of digital literacy.

Even with high beliefs about the importance of digital literacy, educators from this study do not appear to use digital writing resources frequently. Less than forty percent of the

participants used the most frequent resource, learning management systems, on a weekly or daily basis, with the majority of the digital writing resources rarely or never being used. We need to address why educators who clearly acknowledge the importance of digital literacy are not effectively integrating digital writing into their daily routines.

As this study demonstrated, without a distinct understanding of what digital literacy entails, educators will continue to struggle with implementing digital writing strategies. While there are studies identifying specific resources or practices that work well with digital writing, we need to help facilitate these practices across the board, and on a more frequent basis. Based on the comments about not knowing what digital literacy is, awareness needs to start at a basic level and then quickly move forward with training and support to integrate digital writing into classrooms on a more regular basis.

Future Research

The absence of a clear definition of digital literacy was addressed in the literature reviewed in this study. Based on the survey responses, the educators from this study confirmed the confusion surrounding digital literacy still exists. Without an understanding of what digital literacy entails, educators will continue to struggle with and be inefficient at integrating digital writing. Future research focusing on the skills that encompass digital literacy would help give educators a clearer understanding of how to teach digital writing.

Very few studies have taken a comprehensive look at digital writing strategies and resources across multiple grade levels and subjects. While this research looked at digital writing perceptions, resources, and strategies among a wide range of grade levels and content areas, the sample was quite small and therefore not necessarily representative of K-12 educators in general. Future research is needed with larger samples to gain a more comprehensive understanding of

digital writing beliefs, strategies, and resources. Studies that allow for more open responses or follow-up interviews would enhance the knowledge of digital writing.

While it is clear educators recognize the importance of digital writing and believe they are teaching digital literacy, it is unclear why the frequency of digital writing resources was quite low and not aligned with the beliefs. Additional research would be beneficial to gain more information about the frequency of digital writing activities in K-12 schools across a larger sample. Understanding how often digital writing is being taught and how it aligns with educators' beliefs will help provide knowledge to other teachers on best practices for digital writing.

References

- Beeson, I. (2006). Judging relevance: A problem for e-literacy. *Innovation in Teaching and Learning in Information and Computer Sciences*, 5(4), 1-10.
- Bennett, S., Maton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of evidence. *British Journal of Educational Technology*, 39(5), 775-786.
- Buckingham, D. (2006). Defining digital literacy: What do young people need to know about digital media? *Nordic Journal of Digital Literacy*, 1(4), 263-277.
- Center for Technology Implementation. (2013). Power Up What Works. Retrieved from Quick Teacher Technology Survey:
<https://powerupwhatworks.org/sites/default/files/PowerUp%20Teacher%20Survey.pdf>
- Colwell, J., Hunt-Barron, S., & Reinking, D. (2013). Obstacles to developing digital literacy on the Internet in middle school science instruction. *Journal of Literacy Research*, 45(3), 295-325.
- Common Core State Standards Initiative. (2015). Retrieved from corestandards.org
- Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks, California: SAGE Publications.
- Creswell, J. W. (2015). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Saddle River, New Jersey: Pearson Education Inc.
- Cronk, B. (2014). *How to use SPSS: A step-by-step guide to analysis and interpretation*. Glendale, California: Pyrczak Publishing.
- Dalton, B. (2012). Multimodal composition and the common core state standards. *The Reading Teacher*, 66(4), 333-339.

- Ellison, N. B., & Wu, Y. (2008). Blogging in the classroom: A preliminary exploration of student attitudes and impact on comprehension. *Journal of Educational Multimedia Hypermedia*, 17(1), 99-122.
- Gallagher, T. L., Di Cesare, D., & Rowsell, J. (2019). Stories of digital lives and digital divide: Newcomer families and their thoughts on digital literacy. *The Reading Teacher*, 72(6), 774-778.
- Gallardo-Echenique, E. E., Oliveira, J. M., Marques-Molias, L., & Esteve-Mon, F. (2015). Digital competence in the knowledge society. *MERLOT Journal of Online Learning and Teaching*, 11(1), 1-16.
- Gilster, P. (1997). *Digital Literacy*. New York: Wiley Computer Pub.
- Greene, J. A., Yu, S. B., & Copeland, D. Z. (2014). Measuring critical components of digital literacy and their relationships with learning. *Computers & Education*, 76, 55-69.
- Grimes, D., & Warschauer, M. (2008). Learning with laptops: A multi-method case study. *Journal of Educational Computing and Research*, 38(3), 305-332.
- Hall, R., Atkins, L., & Fraser, J. (2014). Defining a self-evaluation digital literacy framework for secondary educators: The DigiLit Leicester project. *Research in Learning Technology*, 22, 1-17.
- Hicks, T., Baleja, K., & Zhang, M. (2019). *Digital Literacy*. In P. Moy (Ed.), *Oxford Bibliographies in Communication*. New York: Oxford University Press.
- Horrigan, J. B. (2016, September). *Digital Readiness Gaps*. Retrieved from Pew Research Center: <http://www.pewinternet.org/2016/09/20/digital-readiness-gaps/>

- Hsu, C.-K., Hwang, G.-J., & Chang, C.-K. (2013). A personalized recommendation-based mobile learning approach to improving the reading performance of EFL students. *Computers & Education*, 63, 327-336.
- Husbye, N. E., & Elsener, A. A. (2013). To move forward, we must be mobile: Practical uses of mobile technology in literacy education courses. *Journal of Digital Learning in Teacher Education*, 30(2), 46-51.
- Hutchison, A., Beschorner, B., & Schmidt-Crawford, D. (2012). Exploring the use of the iPad for literacy learning. *The Reading Teacher*, 66(1), 15-23.
- Jones-Kavalier, B., & Flannigan, S. (2006). Connecting the digital dots: Literacy of the 21st Century. *EDUCAUSE Quarterly*, 1(2), 8-10. Retrieved from EDUCAUSE Review: <https://er.educause.edu/articles/2006/1/connecting-the-digital-dots-literacy-of-the-21st-century>
- Kennedy, K. (2003). Writing with web logs. Retrieved from *Technology and Learning Magazine*.
- Lenhart, A., Arafeh, S., Smith, A., & Macgill, A. (2008, April 24). Writing, technology and teens. Retrieved from Pew Research Center: <http://www.pewinternet.org/2008/04/24/writing-technology-and-teens/>
- Marsh, J., Hannon, P., Lewis, M., & Ritchie, L. (2015). Young children's initiation into family literacy practices in the digital age. *Journal of Early Childhood Research*, 1-14.
- Meyers, E. M., Erickson, I., & Small, R. V. (2013). Digital literacy and informal learning environments: an introduction. *Learning, Media and Technology*, 38(4), 355-267.
- Mohammadyari, S., & Singh, H. (2015). Understanding the effect of e-learning on individual performance: The role of digital literacy. *Computers & Education*, 82, 11-25.

- Nelson, K., Courier, M., & Joseph, G. (2019). An investigation of digital literacy needs of students. *Journal of Information Systems in Education*, 22(2), 95-109.
- Purcell, K., Buchanan, J., & Friedrich, L. (2013, July 16). The impact of digital tools on student writing and how writing is taught in schools. Retrieved from Pew Research Center: <http://www.pewinternet.org/2013/07/16/the-impact-of-digital-tools-on-student-writing-and-how-writing-is-taught-in-schools/>
- Sharples, M. (2002, January). Disruptive devices: Mobile technology for conversation learning. *International Journal of Continuing Engineering Education and Life-Long Learning*, 12(5/6), 504-520.
- Sylvester, R., & Greenidge, W.-I. (2009). Digital storytelling: Extending the potential for struggling writers. *The Reading Teacher*, 63(4), 284-295.
- Yang, W. (2014, May 23). Learning in the field with mobile devices. Retrieved from Literacy Daily: <https://www.literacyworldwide.org/blog/literacy-daily/2014/05/23/learning-in-the-field-with-mobile-devices>
- Zheng, B., Warschauer, M., & Farkas, G. (2013). Digital writing and diversity: The effects of school laptop programs on literacy processes and outcomes. *Educational Computing Research*, 48(3), 267-299.

Appendix A: Digital Literacy Survey

I understand the purpose and nature of this study and I am voluntarily participating. Any identifiable information provided will be removed prior to compiling results. I agree to participate in this study

- a) Yes
- b) No

Demographics

1. What is your gender
 - a. Male
 - b. Female

2. Please select all grades you teach
 - a. Pre K/K
 - b. 1st
 - c. 2nd
 - d. 3rd
 - e. 4th
 - f. 5th
 - g. 6th
 - h. 7th
 - i. 8th
 - j. 9th
 - k. 10th
 - l. 11th
 - m. 12th

3. How many years have you been teaching?

4. Select the main content you teach
 - a. English/Reading
 - b. Mathematics
 - c. Social Studies
 - d. Science
 - e. Other (Please Specify)

5. Select any other content you teach
 - a. English/Reading
 - b. Mathematics
 - c. Social Studies
 - d. Science
 - e. Other (Please Specify)

6. Please provide the number of students in your district. The following website can assist with this:
<https://www.mischooldata.org/districtschoolprofiles2/studentinformation/studentcounts/studentcount.aspx>
If you are unsure, please estimate the number of students in your district
7. School Type
- a. Public
 - b. Private
 - c. Charter
 - d. Other

Technology and Literacy

8. What access do you have to technology? Select all that apply
- a. One-to-one school provided (ex. Laptops, tablets)
 - b. Student provided (ex. Personal laptop, tablet)
 - c. Student cell phone/smartphone
 - d. School Computer labs
 - e. School Laptops
 - f. School Tablets
 - g. Other (please specify)

9. How often do students utilize technology in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
One-to-One School					
Student Provided					
Cell phone/smartphone					
School Computer Lab					
School Laptops					
School Tablets					
Other					

For the purpose of this study, digital literacy is defined as any form of reading, writing, or communicating using some type of digital device (ex. computer, laptop, tablet, cell phone, etc.)

10. Do you feel you teach digital literacy in the classroom?
- a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

11. I feel teaching digital READING is important
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

12. I have had enough professional training in teaching digital READING
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

13. I am comfortable teaching digital READING
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

14. I feel teaching digital WRITING is important
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

15. I have had enough professional training in teaching digital WRITING
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

16. I am comfortable teaching digital WRITING
 - a. Strongly agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly disagree

Literacy

17. How often do students utilize technology for digital **READING** in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
One-to-One School					
Student Provided					
Cell phone/smartphone					
School Computer Lab					
School Laptops					
School Tablets					
Other					

18. How often do students utilize technology for digital **WRITING** in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
One-to-One School					
Student Provided					
Cell phone/smartphone					
School Computer Lab					
School Laptops					
School Tablets					
Other					

19. How often do students utilize the following resources for digital **READING** in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
Reading Apps/websites					
Search Tools/Research					
Learning Management System					
Audio Recordings					
Graphic Organizers/Interactive Posters					
Digital Stories/ Presentations					
Podcast/ Screencasting					
Formative Assessment					
Managing Sources					
Communication					
Note-taking/ Annotations					
Social Media/ Blogging					

20. How often do students utilize the following resources for digital WRITING in your classroom?

	Everyday	A few times a week	A few times a month	Rarely	Never/NA
Editing/ Feedback					
Search Tools/Research					
Learning Management System					
Audio Recordings					
Graphic Organizers/Interactive Posters					
Digital Stories/ Presentations					
Podcast/ Screencasting					
Formative Assessment					
Writing					
Communication					
Note-taking/ Annotations					
Social Media/ Blogging					
Typing Skills					
Spelling/ Grammar					
Digital Portfolio					

21. What strategies do you use to teach digital literacy in the classroom?
22. What resources do you feel assist in teaching digital literacy?
23. Describe an example of how digital literacy appears in your classroom?
24. What difficulties do you find with teaching digital literacy?

Appendix B: One-way ANOVA comparing grade level and digital writing resources

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) Grades	(J) Grades	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Editing/ Feedback	Prek-2	3rd - 5th	.936*	0.311	0.016	0.13	1.75
		6th - 8th	1.116*	0.256	0	0.45	1.78
		9th-12th	1.317*	0.255	0	0.66	1.98
	3rd - 5th	Prek-2	-.936*	0.311	0.016	-1.75	-0.13
		6th - 8th	0.179	0.267	0.908	-0.52	0.87
		9th-12th	0.381	0.267	0.484	-0.31	1.07
	6th - 8th	Prek-2	-1.116*	0.256	0	-1.78	-0.45
		3rd - 5th	-0.179	0.267	0.908	-0.87	0.52
		9th-12th	0.201	0.199	0.742	-0.31	0.72
	9th-12th	Prek-2	-1.317*	0.255	0	-1.98	-0.66
		3rd - 5th	-0.381	0.267	0.484	-1.07	0.31
		6th - 8th	-0.201	0.199	0.742	-0.72	0.31
Search Tools/ Research	Prek-2	3rd - 5th	0.616	0.349	0.294	-0.29	1.52
		6th - 8th	1.059*	0.287	0.002	0.31	1.8
		9th-12th	1.428*	0.286	0	0.69	2.17
	3rd - 5th	Prek-2	-0.616	0.349	0.294	-1.52	0.29
		6th - 8th	0.443	0.3	0.455	-0.34	1.22
		9th-12th	.812*	0.299	0.037	0.04	1.59
	6th - 8th	Prek-2	-1.059*	0.287	0.002	-1.8	-0.31
		3rd - 5th	-0.443	0.3	0.455	-1.22	0.34
		9th-12th	0.369	0.223	0.35	-0.21	0.95
	9th-12th	Prek-2	-1.428*	0.286	0	-2.17	-0.69
		3rd - 5th	-.812*	0.299	0.037	-1.59	-0.04
		6th - 8th	-0.369	0.223	0.35	-0.95	0.21
Learning Management Systems	Prek-2	3rd - 5th	0.969	0.428	0.11	-0.14	2.08
		6th - 8th	1.578*	0.351	0	0.67	2.49
		9th-12th	1.939*	0.35	0	1.03	2.85

	3rd - 5th	Prek-2	-0.969	0.428	0.11	-2.08	0.14
		6th - 8th	0.608	0.367	0.35	-0.34	1.56
		9th-12th	.970*	0.366	0.044	0.02	1.92
	6th - 8th	Prek-2	-1.578*	0.351	0	-2.49	-0.67
		3rd - 5th	-0.608	0.367	0.35	-1.56	0.34
		9th-12th	0.362	0.273	0.548	-0.35	1.07
	9th-12th	Prek-2	-1.939*	0.35	0	-2.85	-1.03
		3rd - 5th	-.970*	0.366	0.044	-1.92	-0.02
		6th - 8th	-0.362	0.273	0.548	-1.07	0.35
Audio Recordings	Prek-2	3rd - 5th	0.236	0.256	0.792	-0.43	0.9
		6th - 8th	0.249	0.21	0.636	-0.3	0.79
		9th-12th	0.41	0.209	0.208	-0.13	0.95
	3rd - 5th	Prek-2	-0.236	0.256	0.792	-0.9	0.43
		6th - 8th	0.013	0.22	1	-0.56	0.58
		9th-12th	0.174	0.219	0.857	-0.39	0.74
	6th - 8th	Prek-2	-0.249	0.21	0.636	-0.79	0.3
		3rd - 5th	-0.013	0.22	1	-0.58	0.56
		9th-12th	0.161	0.163	0.757	-0.26	0.59
	9th-12th	Prek-2	-0.41	0.209	0.208	-0.95	0.13
		3rd - 5th	-0.174	0.219	0.857	-0.74	0.39
		6th - 8th	-0.161	0.163	0.757	-0.59	0.26
Graphic Organizers/ Interactive Posters	Prek-2	3rd - 5th	0.362	0.254	0.486	-0.3	1.02
		6th - 8th	0.294	0.208	0.495	-0.25	0.84
		9th-12th	0.404	0.208	0.214	-0.14	0.94
	3rd - 5th	Prek-2	-0.362	0.254	0.486	-1.02	0.3
		6th - 8th	-0.068	0.218	0.99	-0.63	0.5
		9th-12th	0.042	0.218	0.997	-0.52	0.61
	6th - 8th	Prek-2	-0.294	0.208	0.495	-0.84	0.25
		3rd - 5th	0.068	0.218	0.99	-0.5	0.63
		9th-12th	0.11	0.162	0.905	-0.31	0.53
	9th-12th	Prek-2	-0.404	0.208	0.214	-0.94	0.14
		3rd - 5th	-0.042	0.218	0.997	-0.61	0.52
		6th - 8th	-0.11	0.162	0.905	-0.53	0.31
Digital Stories/ Presentations	Prek-2	3rd - 5th	0.618	0.293	0.154	-0.14	1.38
		6th - 8th	.835*	0.24	0.004	0.21	1.46
		9th-12th	1.007*	0.24	0	0.38	1.63
	3rd - 5th	Prek-2	-0.618	0.293	0.154	-1.38	0.14
		6th - 8th	0.217	0.252	0.824	-0.44	0.87

		9th-12th	0.389	0.251	0.411	-0.26	1.04
	6th - 8th	Prek-2	-.835*	0.24	0.004	-1.46	-0.21
		3rd - 5th	-0.217	0.252	0.824	-0.87	0.44
		9th-12th	0.172	0.187	0.795	-0.31	0.66
	9th-12th	Prek-2	-1.007*	0.24	0	-1.63	-0.38
		3rd - 5th	-0.389	0.251	0.411	-1.04	0.26
		6th - 8th	-0.172	0.187	0.795	-0.66	0.31
Podcasts/ Screencasting	Prek-2	3rd - 5th	0.284	0.216	0.557	-0.28	0.85
		6th - 8th	.464*	0.177	0.048	0	0.92
		9th-12th	.558*	0.177	0.01	0.1	1.02
	3rd - 5th	Prek-2	-0.284	0.216	0.557	-0.85	0.28
		6th - 8th	0.18	0.186	0.766	-0.3	0.66
		9th-12th	0.274	0.185	0.451	-0.21	0.76
	6th - 8th	Prek-2	-.464*	0.177	0.048	-0.92	0
		3rd - 5th	-0.18	0.186	0.766	-0.66	0.3
		9th-12th	0.094	0.138	0.904	-0.26	0.45
	9th-12th	Prek-2	-.558*	0.177	0.01	-1.02	-0.1
		3rd - 5th	-0.274	0.185	0.451	-0.76	0.21
		6th - 8th	-0.094	0.138	0.904	-0.45	0.26
Formative Assessment	Prek-2	3rd - 5th	0.578	0.327	0.293	-0.27	1.43
		6th - 8th	1.181*	0.269	0	0.48	1.88
		9th-12th	1.191*	0.268	0	0.5	1.89
	3rd - 5th	Prek-2	-0.578	0.327	0.293	-1.43	0.27
		6th - 8th	0.603	0.281	0.143	-0.13	1.33
		9th-12th	0.613	0.28	0.131	-0.11	1.34
	6th - 8th	Prek-2	-1.181*	0.269	0	-1.88	-0.48
		3rd - 5th	-0.603	0.281	0.143	-1.33	0.13
		9th-12th	0.01	0.209	1	-0.53	0.55
	9th-12th	Prek-2	-1.191*	0.268	0	-1.89	-0.5
		3rd - 5th	-0.613	0.28	0.131	-1.34	0.11
		6th - 8th	-0.01	0.209	1	-0.55	0.53
Writing	Prek-2	3rd - 5th	0.929	0.382	0.076	-0.06	1.92
		6th - 8th	1.450*	0.314	0	0.63	2.26
		9th-12th	1.779*	0.313	0	0.97	2.59
	3rd - 5th	Prek-2	-0.929	0.382	0.076	-1.92	0.06
		6th - 8th	0.521	0.328	0.39	-0.33	1.37
		9th-12th	0.85	0.328	0.05	0	1.7
	6th - 8th	Prek-2	-1.450*	0.314	0	-2.26	-0.63

		3rd - 5th	-0.521	0.328	0.39	-1.37	0.33
		9th-12th	0.329	0.244	0.534	-0.3	0.96
	9th-12th	Prek-2	-1.779*	0.313	0	-2.59	-0.97
		3rd - 5th	-0.85	0.328	0.05	-1.7	0
		6th - 8th	-0.329	0.244	0.534	-0.96	0.3
Communication	Prek-2	3rd - 5th	0.436	0.377	0.655	-0.54	1.42
		6th - 8th	1.519*	0.31	0	0.71	2.32
		9th-12th	1.748*	0.309	0	0.95	2.55
	3rd - 5th	Prek-2	-0.436	0.377	0.655	-1.42	0.54
		6th - 8th	1.083*	0.324	0.006	0.24	1.92
		9th-12th	1.312*	0.323	0	0.47	2.15
	6th - 8th	Prek-2	-1.519*	0.31	0	-2.32	-0.71
		3rd - 5th	-1.083*	0.324	0.006	-1.92	-0.24
		9th-12th	0.229	0.241	0.777	-0.4	0.85
	9th-12th	Prek-2	-1.748*	0.309	0	-2.55	-0.95
		3rd - 5th	-1.312*	0.323	0	-2.15	-0.47
		6th - 8th	-0.229	0.241	0.777	-0.85	0.4
Note-taking/ Annotations	Prek-2	3rd - 5th	0.642	0.304	0.154	-0.15	1.43
		6th - 8th	.925*	0.25	0.002	0.28	1.57
		9th-12th	1.063*	0.249	0	0.42	1.71
	3rd - 5th	Prek-2	-0.642	0.304	0.154	-1.43	0.15
		6th - 8th	0.283	0.261	0.7	-0.39	0.96
		9th-12th	0.422	0.261	0.371	-0.25	1.1
	6th - 8th	Prek-2	-.925*	0.25	0.002	-1.57	-0.28
		3rd - 5th	-0.283	0.261	0.7	-0.96	0.39
		9th-12th	0.139	0.194	0.891	-0.37	0.64
	9th-12th	Prek-2	-1.063*	0.249	0	-1.71	-0.42
		3rd - 5th	-0.422	0.261	0.371	-1.1	0.25
		6th - 8th	-0.139	0.194	0.891	-0.64	0.37
Social Media/ Blogging	Prek-2	3rd - 5th	0.295	0.291	0.743	-0.46	1.05
		6th - 8th	0.349	0.239	0.464	-0.27	0.97
		9th-12th	.685*	0.238	0.024	0.07	1.3
	3rd - 5th	Prek-2	-0.295	0.291	0.743	-1.05	0.46
		6th - 8th	0.054	0.25	0.996	-0.59	0.7
		9th-12th	0.39	0.249	0.401	-0.26	1.04
	6th - 8th	Prek-2	-0.349	0.239	0.464	-0.97	0.27
		3rd - 5th	-0.054	0.25	0.996	-0.7	0.59
		9th-12th	0.336	0.186	0.273	-0.15	0.82

	9th-12th	Prek-2	-.685*	0.238	0.024	-1.3	-0.07
		3rd - 5th	-0.39	0.249	0.401	-1.04	0.26
		6th - 8th	-0.336	0.186	0.273	-0.82	0.15
Typing Skills	Prek-2	3rd - 5th	0.604	0.405	0.446	-0.45	1.66
		6th - 8th	0.31	0.332	0.787	-0.55	1.17
		9th-12th	0.533	0.332	0.377	-0.33	1.39
	3rd - 5th	Prek-2	-0.604	0.405	0.446	-1.66	0.45
		6th - 8th	-0.293	0.348	0.833	-1.2	0.61
		9th-12th	-0.071	0.347	0.997	-0.97	0.83
	6th - 8th	Prek-2	-0.31	0.332	0.787	-1.17	0.55
		3rd - 5th	0.293	0.348	0.833	-0.61	1.2
		9th-12th	0.223	0.258	0.824	-0.45	0.89
	9th-12th	Prek-2	-0.533	0.332	0.377	-1.39	0.33
		3rd - 5th	0.071	0.347	0.997	-0.83	0.97
		6th - 8th	-0.223	0.258	0.824	-0.89	0.45
Spelling/ Grammar	Prek-2	3rd - 5th	0.696	0.38	0.262	-0.29	1.68
		6th - 8th	0.56	0.312	0.28	-0.25	1.37
		9th-12th	1.060*	0.311	0.005	0.25	1.87
	3rd - 5th	Prek-2	-0.696	0.38	0.262	-1.68	0.29
		6th - 8th	-0.136	0.326	0.975	-0.98	0.71
		9th-12th	0.364	0.326	0.68	-0.48	1.21
	6th - 8th	Prek-2	-0.56	0.312	0.28	-1.37	0.25
		3rd - 5th	0.136	0.326	0.975	-0.71	0.98
		9th-12th	0.5	0.243	0.17	-0.13	1.13
	9th-12th	Prek-2	-1.060*	0.311	0.005	-1.87	-0.25
	3rd - 5th	-0.364	0.326	0.68	-1.21	0.48	
	6th - 8th	-0.5	0.243	0.17	-1.13	0.13	
Digital Portfolio	Prek-2	3rd - 5th	-0.055	0.284	0.997	-0.79	0.68
		6th - 8th	-0.161	0.233	0.9	-0.77	0.44
		9th-12th	0.193	0.232	0.84	-0.41	0.8
	3rd - 5th	Prek-2	0.055	0.284	0.997	-0.68	0.79
		6th - 8th	-0.107	0.244	0.972	-0.74	0.53
		9th-12th	0.248	0.243	0.739	-0.38	0.88
	6th - 8th	Prek-2	0.161	0.233	0.9	-0.44	0.77
		3rd - 5th	0.107	0.244	0.972	-0.53	0.74
		9th-12th	0.355	0.181	0.209	-0.12	0.82
	9th-12th	Prek-2	-0.193	0.232	0.84	-0.8	0.41
	3rd - 5th	-0.248	0.243	0.739	-0.88	0.38	

		6th - 8th	-0.355	0.181	0.209	-0.82	0.12
--	--	-----------	--------	-------	-------	-------	------

* The mean difference is significant at the 0.05 level.

Appendix C: One-way ANOVA comparing content and digital writing resources

Multiple Comparisons							
Tukey HSD							
Dependent Variable	(I) Grades	(J) Grades	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Editing/ Feedback	English/ Reading	Mathematics	-1.057*	0.257	0.001	-1.77	-0.35
		Social Studies	-0.518	0.364	0.614	-1.52	0.49
		Science	-0.455	0.266	0.431	-1.19	0.28
		Other	-0.558	0.213	0.072	-1.15	0.03
	Mathematics	English/ Reading	1.057*	0.257	0.001	0.35	1.77
		Social Studies	0.539	0.384	0.626	-0.52	1.6
		Science	0.602	0.293	0.245	-0.21	1.41
		Other	0.499	0.246	0.257	-0.18	1.18
	Social Studies	English/ Reading	0.518	0.364	0.614	-0.49	1.52
		Mathematics	-0.539	0.384	0.626	-1.6	0.52
		Science	0.063	0.39	1	-1.01	1.14
		Other	-0.04	0.356	1	-1.02	0.94
	Science	English/ Reading	0.455	0.266	0.431	-0.28	1.19
		Mathematics	-0.602	0.293	0.245	-1.41	0.21
		Social Studies	-0.063	0.39	1	-1.14	1.01
		Other	-0.103	0.255	0.994	-0.81	0.6

		English/ Reading	0.558	0.213	0.072	-0.03	1.15
	Other	Mathematics	-0.499	0.246	0.257	-1.18	0.18
		Social Studies	0.04	0.356	1	-0.94	1.02
		Science	0.103	0.255	0.994	-0.6	0.81
		Mathematics	-0.886*	0.298	0.027	-1.71	-0.06
Search Tools/ Research	English/ Reading	Social Studies	-0.419	0.422	0.858	-1.58	0.74
		Science	-0.283	0.308	0.89	-1.13	0.57
		Other	-0.359	0.247	0.595	-1.04	0.32
		Mathematics	English/ Reading	.886*	0.298	0.027	0.06
	Social Studies		0.467	0.445	0.832	-0.76	1.69
	Science		0.603	0.339	0.39	-0.33	1.54
	Other		0.527	0.285	0.348	-0.26	1.31
	Social Studies	English/ Reading	0.419	0.422	0.858	-0.74	1.58
		Mathematics	-0.467	0.445	0.832	-1.69	0.76
		Science	0.136	0.452	0.998	-1.11	1.38
		Other	0.06	0.413	1	-1.08	1.2
	Science	English/ Reading	0.283	0.308	0.89	-0.57	1.13
		Mathematics	-0.603	0.339	0.39	-1.54	0.33
		Social Studies	-0.136	0.452	0.998	-1.38	1.11
		Other	-0.076	0.296	0.999	-0.89	0.74
	Other	English/ Reading	0.359	0.247	0.595	-0.32	1.04
		Mathematics	-0.527	0.285	0.348	-1.31	0.26
		Social Studies	-0.06	0.413	1	-1.2	1.08
		Science	0.076	0.296	0.999	-0.74	0.89
	Writing	English/ Reading	Mathematics	-1.070*	0.332	0.013	-1.99
Social Studies			-0.447	0.469	0.876	-1.74	0.85

	Science	-0.328	0.343	0.875	-1.27	0.62
	Other	-0.547	0.275	0.276	-1.31	0.21
Mathematics	English/ Reading	1.070*	0.332	0.013	0.16	1.99
	Social Studies	0.624	0.495	0.716	-0.74	1.99
	Science	0.743	0.378	0.287	-0.3	1.78
	Other	0.524	0.317	0.467	-0.35	1.4
	English/ Reading	0.447	0.469	0.876	-0.85	1.74
Social Studies	Mathematics	-0.624	0.495	0.716	-1.99	0.74
	Science	0.119	0.503	0.999	-1.27	1.51
	Other	-0.1	0.459	0.999	-1.37	1.17
	English/ Reading	0.328	0.343	0.875	-0.62	1.27
Science	Mathematics	-0.743	0.378	0.287	-1.78	0.3
	Social Studies	-0.119	0.503	0.999	-1.51	1.27
	Other	-0.219	0.329	0.963	-1.13	0.69
	English/ Reading	0.547	0.275	0.276	-0.21	1.31
Other	Mathematics	-0.524	0.317	0.467	-1.4	0.35
	Social Studies	0.1	0.459	0.999	-1.17	1.37
	Science	0.219	0.329	0.963	-0.69	1.13

* The mean difference is significant at the 0.05 level.