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TECHNOLOGY IN THE CLASSROOM

Technology Instruction in the Classroom: Effects on Struggling Writers' Success

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Northwestern College

A Literature Review Presented

In Partial Fulfillment of the Requirements

For the Degree of Master of Special Education

Dr. Theresa Pedersen

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Abstract

Technology use within the writing classroom for writers who struggle can offer independence and lead to success. This literature review examines the use of technology with struggling writers, the effects of technology use of student engagement, specific strategies used for the implementation of technology, and the professional development opportunities presented to educators for this implementation. The research affirms the benefits of assistive technology within the writing classroom and the importance for the training of educators to properly utilize and engage technology within their classrooms promoting student success and achievement.

Keywords: Assistive technology, technology, struggling writers, writing instruction

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Technology Instruction in the Classroom: Effects on Struggling Writers' Success

Many arguments exist as to the immense amount of screen time young children are receiving within the school setting. Questions of how much screen time young children should receive are tied to the purpose behind the use of screen time, especially in a classroom setting. More specifically, the purpose and effects of screen time and technology use in the classroom setting should be considered key factors in answering the question of how much screen time young children should receive. As stated by Alnahdi (2014), assistive technology use doesn't need to be high cost or specially designed to be effective, but rather purposefully chosen and implemented to meet the needs of students with disabilities. Technology can be incorporated into a classroom setting in many different, valuable ways. Researchers Peterson-Karlan (2011), Tanimoto (2015), and Alnahdi (2014) claim during writing instruction, technology can be used in the form of assistive technology and as a learning tool during specially designed instruction for struggling writers to gain independence in the area of writing.

A great deal of research has been done about the use of specific technologies within the writing classroom, and even a plethora of research about the effects of the use of assistive technology in the special education and inclusive settings. Leading researchers in this area include Ahmad (2015), Bouck et al. (2012), and Rowland et al. (2020). Ahmad (2015) states that education should be inclusive and, to do so properly, should meet the needs of the individual learner by utilizing technology to provide access to the general education curriculum for all learners.

The problem is that research does not specify the effects and benefits of technology use when used with struggling writers. Students who struggle in the writing classroom oftentimes

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lack access to the general education curriculum and require the use of research-based assistive technologies to meet their learning needs in this content area. Left unaddressed, this problem can cause a significant attainment-gap in the area of writing and hamper the inclusion of writers who struggle within the general education classroom.

The driving purpose of this study is to analyze the effects of technology use within the writing classroom and present specific benefits that result from its usage for writers who struggle including students who receive specially designed instruction. Review of each study will indicate how educators can effectively utilize technology to accommodate instruction and meet the needs of individual writing needs to foster an inclusive learning environment.

This review will explore the research surrounding the use of technology within the writing classroom including specific forms of assistive technology and strategies for implementation. Research based peer-reviewed articles were examined for this literature review based upon keywords such as: writing and technology instruction, writing strategies and technology, struggling writers and technology, disabilities and writing technology. Research-based peer reviewed journal articles, published within the last 10 years, present a variety of viewpoints along with relevant up-to-date technology information were used in this literature review. Articles used in this review were located using the DeWitt Library online database and Google Scholar search engine.

The structure of this review is thematic. The themes outlined are technology use for struggling writers, how technology use affects student engagement, specific strategies for technology use in writing instruction, and professional development surrounding technology use in the writing classroom.

Review of the Literature

Technology Use for Struggling Writers

In order to examine the effects and benefits of technology use in a writing classroom specific to struggling writers, an understanding of what makes a struggling writer must be defined. A struggling writer is one who has difficulty accessing the general education curriculum and performs below the grade-level expected benchmark on assignments and assessments. Struggling writers oftentimes are diagnosed with a learning or physical disability that inhibit their ability to meet grade-level curriculum expectations in the area of writing instruction. It was understood by researchers Bouck, Flanagan, Miller, and Bassette (2012) how important it would be to identify what could be done to augment student success through the use of technology for the individual. Similarly Peterson-Karlan (2011) supported the concept of identifying the struggle and then providing appropriate assistive technology.

Graham, Harris, Bartlett, Popadopoulou, and Santoro (2016) found that academic support and accommodations were crucial for access to the general education curriculum and college and career opportunities. Leading adaptations provided by educators on a daily basis were encouragement utilized by 74% of participants, invented spelling utilized by 29% of participants, and capitalization/punctuation instruction utilized by 22% of participants. During Graham et al's (2016), technology was the least likely tool to be utilized by educators on a daily basis and was only utilized by 3% of participants to provide these adaptations. Moreover, Alnahdi (2014) agreed with Graham et al. (2016), extending the research in his study about Universal Design for Learning and technology use. Alnahdi (2014) found by activities using technology increased independence for students with intellectual disabilities. However according to Graham and his team (2016), the Common Core Standards provided a set of benchmarks that students in a

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particular grade level were expected to meet but did not provide a methodology for teaching writing. Alnahdi (2014) reported that the leading advantages of technology use for meeting the instructional needs of students with disabilities includes maximizing student independence, increasing the level of student participation in discussions, and allowing students access to peer and mentor communities.

Among those who believe that technology use has a positive impact on struggling writers are researchers Tanimoto, Thompson, Berninger, Nagy, and Abbott (2015). Tanimoto and the team (2015) began by introducing the eye-opening statistic that one in five school-aged students in the United States had a specific learning disability (SLD). Participants in Tanimoto's study included 21 students in grades 4-9 who completed 19 technology-based lessons targeted towards one of three intervention areas (dysgraphia, dyslexia, and oral and written language learning). Computerized lessons were followed by a conferring session and goal setting for the next lesson with an in-person educator. The purpose of this research was to explore the possibilities for computerized lessons to successfully teach students handwriting, morphophonemic orthographies (written symbols that correlate with spoken sound), comprehension, and composition. The findings of Tanimoto et al.'s (2015) study were that students with a diagnosis of SLD showed much greater response to a technology intervention in the areas of writing, reading, and math when the intervention was targeted at the areas of need. The areas with the largest effect size given the use of technology included cursive writing, sentence accuracy, and fluency writing. Key factors educators considered when utilizing technology in the classroom could be derived from this study. Providing students with technology does not directly have an impact on the students' performance without specifically tailoring instruction to meet the instructional needs of the student (Tanimoto et al., 2015). Juxtaposed with Graham et al.'s

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(2016) study this highlighted the benefit of technology in the classroom for differentiated instruction, specific student content needs, and collecting Response to Intervention (RTI) data for students with and without SLD.

Similar to the views of Tanimoto et al. (2015), Peterson-Karlan (2011), showed that technology boosted students' performance. Peterson-Karlan (2011) analyzed 85 research studies over a 25-year period and explored the ways in which technology has advanced and evolved the subject area of writing. Not only did technology provide new and innovative ways including speech-to-text and word prediction software for students to compose informal and formal pieces of written work, but technology has also altered the way writing has been taught (2011). Digging deeper into Peterson-Karlan's (2011) ideology, it was found that when assistive technology was used by students during the four phases of the writing process (planning, transcribing, editing, and revising) the overall writing of the students improved. Of the data analyzed, the leading areas for research including the percentage of studies that included research were the use of word processing and graphic organizer at 60%, spell checkers at 90% and word processing and peer strategies at 40%. Similar to Peterson-Karlan's (2011) findings, other researchers replicated the ideals that utilizing strategies such as speech-to-text, word prediction software, and other features offered by a word processor can lead to effective methods of teaching students with learning disabilities by applying his theories in their own work. Additionally, Rowland, Smith, and Lowrey (2020), found the students' use of technology enhanced instruction of the six traits of writing program (voice, ideas, presentation, conventions, organization, word choice, and sentence fluency) which improved the overall writing product through the use of assistive technology. The support assistive technology can provide includes engaging students in collaboration, use pictures to help tell a story, word predicting, and grammar software.

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When implemented with fidelity and purpose, Adebisi, Liman, and Longpoe (2015) have found that the use of assistive technology should be used to enhance students' basic skills rather than act as a replacement. The authors' purpose of conducting this study was to explore the reasons why assistive technology might be used in the classroom, specifically for students with learning disabilities. Adebisi et al. (2015) explored specific strategies for technology integration. Tools found by the researchers to offer an enhancement to the skills of learners include spell checkers, grammar checkers, speech synthesizers, and speech recognition software. According to Adebisi et al. (2015), the use of assistive technology in the area of writing to motivate learners, increase writer productivity, and promote peer acceptance among students. Likewise Blackwell, Lauricella, and Wartella (2014) explored technologies and their utilizations. The study yielded data proving that technology use in the classroom alone is not a successful instructional strategy but allows for scaffolding. Learner confidence with technology use increased by 13% when given educator support and a technology policy put in place by educators led to an 8% increase. Researchers Adebisi et al. (2015) and Blackwell et al. (2014) agreed instructor attitude and confidence were the two biggest factors when technology integration was evident.

Technology use and Student Engagement

The findings of a study by Rashid and Asghar (2016) identified a positive correlation between the use of technology and the students' engagement and self-directed learning. Furthermore they concluded that, although there is a positive effect on technology use and student engagement and self-directed learning, there is not a notable effect of technology use and students' academic performance. All participants utilized technology daily, their preference for a form of technological communication weighing heavily on email. In this study the authors explored whether or not the widespread access and use of technology had an effect on the

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engagement of students. Participants of the study were analyzed using a shortened version of the Utrecht's work engagement scale. This scale assessed vigor, absorption and dedication and scored the frequency of occurrence of items on a six-point scale ranging from never (0) to always (6). Since the participants included 761 undergraduate students, their communication preference was through the use of email. These researchers found that using email as an instructional strategy had a positive effect of a 19% increase in student engagement. Similarly, Taylor and Parsons (2011) added that specific technology such as email improved student motivation and allowed students to interact with people and places from around the community, country, and world when it just was not possible to physically leave the classroom. According to researchers Taylor and Parsons (2011), the use of technology within the classroom setting motivated 51% of learners.

Oraib Mango (2015), another researcher who has conducted a study on technology use and student engagement, has set out to analyze the use of iPads and their effects on students' active learning. Mango's study consisted of thirty-five college students in the Southwestern United States. The students were provided with iPads to utilize when completing collaborative projects that, according to Mango, relied on the following apps: Educreations, Doodle Buddy, Aviary, StoryKit, ShowMe, Screen Chomp, and Comic Life. The results of Mango's study indicated that, according to participant accounts, not only did the students feel more engaged with their learning, but also that it was easier to collaborate with others using the given technology. Mango (2015) found participation, collaboration, enjoyment, and creativity all increased given the use of iPads for student instruction. This was shown through a mean ranging from 4.18 to 4.43 which showed the iPad use to have positive effects on student engagement. Differing from Rashid et al.'s (2016) study, Mango (2015) did note a specific link with student

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academic success in the classroom. This link was found to be increased collaboration within the classroom and was shown to have a connection with material retention and is shown through a mean of 4.43 indicating a positive impact given the use of iPads for instruction.

When examined by Schindler, Burkholder, Morad, and Marsh (2017) the use of computer-based technology within the classroom environment increased student engagement, such as through the use of social media platforms. For example, the use of Facebook for instruction was shown to lead to a participation rate of up to 95%. Another form of technology instruction researched included blogging. Blogging was shown to increase student interaction by allowing students to share their own ideas and personal experiences as well as interact with their peers' posts through comments. An example of software studied was the use of blogs and social networking such as email, and Schindler et al's (2017) findings agree with those of Rashid (2016) and Mango (2015). Additionally, McGrail and Davis (2011) studied blogging and its effects on elementary students with the purpose of its influence on student writing. They claimed blogging is writing on a more personal level that helped to promote student engagement and interest.

Students who participated were involved in lessons about blogging which included publishing blogs and conversing about these blogs in a collaborative setting. Student pre and post blogs were analyzed utilizing the following domains: attitude, content, voice, connection/relationships with audience/peers, thinking, and craft. Data from this 2011 study shows the growth of students in each of these six domains through the use of classroom blogging and the lessons and collaboration that came along with this innovative way of publishing student work. Growth is shown by the researchers as they note which domain areas were present during both pre and post blogging writing samples. The areas noted as present during pre-blogging

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samples within the six domains include motivation, excitement, confidence skills/literacies, and elaboration. During the post-blogging samples, in addition to the areas present for the pre sample, the following areas were shown in student writing samples. Interests, analysis, empowered, reflective, connection with readers, networking, critical thinking, vocabulary, and transition were all present. As with Schindler's (2017) team, McGrail and Davis (2011) found evidence of increased student engagement. An example of this growth includes the following comment by a 5th grader in McGrail and Davis' study. *"Hi and bye everybody this is MIA an almost 6th grader. I'm here to tell Lani, Toni, Ms. C, An April, and everyone else who has been commenting in my blog. Ya'll are so special to me. It is so hard to leave behind something you love so much. Good-bye for now, my friends"* (McGrail and Davis., 2011, p. 426). Not only did the researchers note student growth in all of the identified areas, but it was also clear through student comments and accounts that they had a personal connection and were engaged and motivated as active members in their own learning. Complementary to Mango (2015) and McGrail and Davis (2011), Schindler et al.'s (2017) research indicated a strong connection between the use of technology paired with collaboration on the positive effects of student engagement in the classroom through student accounts.

As recently as 10 years ago when 1:1 student device programs were prevalent in many districts in the United States, researchers began to study the effects technology had on student engagement. Banitt, Theis, and Van Leeuwe (2013) noted even though it was generally known students were more excited and motivated by the use of technology, their purpose was to analyze media use. Since they noted that teenagers spend an average of seven and one half hours per day on devices, their study analyzed the possibility to harness the connection between technology use and student engagement within the classroom. It was found by the researchers 76% of students

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completed work online as opposed to 71% of students who completed the work that was printed. It was also found that students were more likely to turn in assignments late when online and left only 20% of assignments failed to reach completion as opposed to 27% of printed assignments. In this study, 50% of students reported that technology positively impacted their learning while only 3% of students felt a negative impact. The data showed that the vast majority of students benefitted from the integration of technology within the classroom and showed an increased overall engagement of students across all data collection methods. When surveyed about the use of the Schoology program, 75% of students indicated that the usage should continue.

Incongruent with the ideas of Banitt et al. (2013) Taylor and Parsons (2011) studied the effects of technology in the changing classrooms. They found students craved personal interaction and relationships with their teachers and other learners. While these concerns were being looked at, Taylor and Parsons (2011) also explored students' needs for their knowledge to be larger than the four walls in which they learned. Taylor et al. (2011) used numbers from Project Tomorrow (2010) as a foundation for their research including a 78% increase in student engagement when utilizing technology for classroom practices. While educators were still hotly debating its heavy usage, they concluded that these benefits may help students to remain in school.

Researcher Guvenc (2018), examines the perceptions of students in a writing classroom that follows a flipped classroom approach. The flipped approach weighs heavily on learner-based instruction and includes out-of-class work. This action research works to more fully understand the learning outcome and the challenges of utilizing this teaching method in the writing classroom. The study was conducted within an English Language Preparatory School on a program that provides intensive English instruction to students. There were 23 reading and

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writing students who were expected to have studied assigned links on flipped weeks. 19-20 year-old students were included in the study. Students involved in the study responded well to the flipped, or student-guided method of teaching with 85% of student reporting to favor this model. Opposing to this, 15% of students were not interested and did not favor the use of computers or other technology sources to drive their learning. Most students also enjoyed the efficient use of class time having already arrived in class after being self-guided through material.

Specific Devices and Strategies for Technology Use in the Writing Classroom

In addition to the use of technology for students who have MSD, Bouck, Flanagan, Miller, and Bassette (2012), believe most students benefitted from the use of technology. Their purpose through research was to explore and share the benefits of using innovative technology strategies within the classroom. More specific to the individual student's needs, the authors defined assistive technology for the purpose of their research as an item that has been customized or purchased for increased accessibility to general education curriculum. One form of assistive technology described by Bouck et al. (2012) is the use of Tag Reader. Baseline data showed a score for written comprehension to begin with 0. Following a ten-session intervention utilizing Tag Reader, the student's score for written comprehension climbed to 5. As technology has been rethought, it could now be seen as a device that included educational apps that provide visual, auditory, and tactile learning opportunities to students with disabilities. Like Bouck et al. (2012), Ahmad (2015) conducted a study about the use of assistive technology within the inclusive setting, examined assistive technology use in a variety of areas or areas of function including: reading, writing, math, vision, hearing, computer access/usage, alternative forms of communication and for students with LD or ADHD. The recommended forms of assistive technology in the area of writing include pencil grips, templates, word processors, word

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walls/spelling books, spelling and grammar checkers, and other forms of computer software. All of these researchers emphasized affordability of the various types of assistive technology as crucial to their success.

Before technology can be utilized, it is important to first consult the research for specific strategies and skills for technology implementation in the classroom. In Ahmad's (2015) research, it was reported that the technologies needed to be appropriate for the environment and easy to use. Another author believing that technology provided positive instructional outcomes to writers who struggle was researcher Pennington (2016). The researcher's purpose through his study was to illustrate the implementation of assistive technology to teach writing skills to students who have MSD with a focus on the Four Step Approach. The four steps used for writing instruction for students with MSD included: plan for meaningful opportunities, selecting assistive technology to support instruction, use research-based instructional strategies, and monitor student progress. Programs suggested included Clicker 6, Clicker sentence, Clicker connect, First Author, Pixwriter, and Symbol Support. Data showed, when a student with MSD was given a sentence prompt and offered assistive technology of choice, the student grew from writing with 40% accuracy to 80% accuracy in one data collection period of two weeks.

Rethinking technology is a powerful method for utilizing many different strategies for targeting specific students' needs when it comes to technology integration. Specific strategies introduced by researchers Bouck and team (2012) were auto correct in Microsoft Word, Livescribe smart pen, and Tag Reader. The use of autocorrect in Microsoft Word was originally purposed to pick up on spelling and grammatical errors in typed text. This strategy could be innovatively used by educators programming in high frequency spelling words to easily recognize mistakes and automatically offer the student the correct spelling of a word. The

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Livescribe smart pen was originally purposed to provide its user with the chance to relisten to something recorded on the pen and can even send information via email. This piece of technology reinvented could be utilized to assist writers who struggled with the physical act of writing, who struggled with memory, or who struggled with note-taking accommodations. Tag Reader, like the children's toy Leapfrog learning pen, was traditionally used in the home for fun. When reinvented at school this could serve young children with disabilities in the area of reading with word and letter support as they developed their skills. Data showed that the use of Tag Reader, given ten intervention sessions, was shown to increase student written comprehension from a score of 0 to a score of 5. Student oral comprehension was shown to increase from a score of 1 to a score of 6. As Bouck et al. (2012) and Ahmad (2015) have both stressed, rethinking technology was a cheap way to use a resource that was already accessible to students.

Consistent with Bouck et al. (2012) and Ahmad (2015), Rowland, Smith, and Lowrey (2020) studied many free or low-cost options for technology use. In fact, many of the strategies for technology use suggested by Rowland et al. (2020) were free with a given device (i.e.: laptop computer). They believed that teaching writing through the six traits approach and pairing this instruction with technology integration, was a positive way that led success of writers who struggled by using strategies and resources including the examples listed. Answer Garden, Padlet, Popplet, Storyboard That, Speech-to-Text Technology, Toontastic, YouTube, Word Band Universal, Microsoft Word, various forms of social media, Grammarly, and Text-to-Speech technologies were all forms of assistive software that helped accommodate struggling writers. Although these tools were useful in assisting students and enriching lessons, data-driven decision making should be the driving force behind planning.

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The research-based suggested strategies presented were spell checkers, proofreading or grammar checkers, speech synthesizers or text-to-speech technologies, and speech recognition or text-to-speech technologies all came at a low cost when provided with a computer and many word processing programs. Researchers Adebisi, Linman, and Longpoe (2015) also introduced economical strategies for the use of assistive technology. Their research mirrored Rowland et al. (2020), Ahmad (2015), and Bouck et al. (2012) in many of the strategies however, in contrast to other researchers, they found there was room for error with spell checkers, proofreading or grammar checkers, speech synthesizers or text-to-speech technologies, and speech recognition or text-to-speech technologies. Examples of this included the misuse of the words *their* and *there* would be difficult to interoperate for a student who struggled and, although a grammar checker may offer these options, the student may not be able to make an accurate selection. These were not perfect tools; the biggest barrier noted by the authors was students utilizing these strategies had a hard time identifying whether or not they were selecting the proper spelling or grammatical change, or if the speech-to-text processor properly documented their spoken text.

As Bouck et al. found with LiveScribe smart pen, Alnahdi (2014) shared how independence could be increased for students through the use of computer software programs and pen-top computers. The example was presented that, given an upper level student who cannot calculate basic math facts independently, providing a calculator is a form of assistive technology that offered a real-word solution. Exploring options further Alnahdi (2014) explains that a student who was unable to read a presented number could utilize a talking calculator to engage independence. According to Ghaleb's (2014) study, it was shown that the computer software program that could be utilized when purchased and downloaded on a computer or tablet, and that included word prediction software and speech-to-text technology led to five out

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of seven students showing improvements with the number of words produced as well as improvements in the number of words spelled correctly. Additionally, pen-top computers such as FLYPen, which included providing voice output direction and prompts for writers are shown to increase student success. Data showed that this pen increased the success and independence of struggling writers with 100% of students with mild disabilities showing gains in the quality of written expression.

The use of a specific writing instructional program that included access to assistive technology was explored by Wollak and Koppenhaver (2011), researchers of assistive technology devices. Wollak and Koppenhaver point out that writing was used across all content areas to communicate students' understanding of subjects and specific topics. According to Wollak et al. (2011), struggling writers had difficulties for a number of reasons, including limited or no access to assistive technologies. Participants in the Inclusion Program were identified as having moderate to severe intellectual disabilities, autism spectrum disorders, physical impairments, or other health impairments. Students were in 7th and 8th grade. There were 110 students with varying levels of ability. Co:Writer was the writing program used. This keyboard program assisted with word prediction software. Approximately 80% of research participants learned to use Co:Writer independently within just six classes during the study. Students were also encouraged to seek peer support with questions about CoWriter to help further promote their independence. On the flip of this, 20% of participants had more difficulty using this keyboard program. As found in Adebisi et al.'s research (2015), assistive technology was not a perfect system, and instructor intervention was still largely required to promote student success.

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Assistive technology was used to help promote skill development and not just to make up for students' disabilities. Researchers Svensson, Nordstrom, Lindeblad, Gustafson, Bjorn, Sand, Almgren, and Nilsson (2019) worked to explore the effects of assistive technology on students with severe literacy disabilities. This research study included 149 students who received an intervention that included 24 sessions of assistive technology training. It was widely found across Svensson et al.'s (2019) study across multiple grade levels that the test group outperformed the control group in nearly all areas tested including word recognition, written words, and sentence change given the support of assistive technology. Although it was not completely evident whether or not assistive technology was the only cause, it was made clear by Svensson et al. (2019) and also found by Wollak et al. (2011) and Adebisi (2015) that assistive technology played a large role in meeting the needs of students with literacy disabilities and helping them to achieve success in the classroom.

In addition to tools, apps, and teaching techniques, allowing for online discussion and helping to reduce the language-barrier stress made social networking sites a potentially fantastic tool for ESL students and even those who struggled academically to have access to their peers across a broad learning platform. Researchers Yunus, Salehi, and Chenzi (2012) explored just this in their research. This qualitative study examined participant data utilizing online discussion board guided by questions that aimed to explore pre-service teachers' opinions about utilizing social networking sites within the writing classroom, specifically the English as a Second Language (ESL) writing classroom. Upon collaboration of the participants, it was found that social networking sites did offer many benefits to ESL writing students by allowing students many opportunities to interact with others in a low-stress environment. The lasting benefits of this type of learning can include enhancing student understanding of technology tools. Social

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networking sites such as Facebook was noted to help increase teacher-teacher relationships as well as teacher-student relationships. Teachers in the study reported using Facebook to create virtual classrooms to engage student thinking and brainstorming abilities. Process writing required the author to closely analyze their topic, language usage, writing purpose, and their audience when writing. This process had differences across various levels and classrooms, but included prewriting, feedback from the teacher, and a revision step. According to another researcher, Boas (2011), the process approach to writing could also be supported through the use of blogs and social networking sites such as *Ning*, again confirming finding from Yunus et al. (2012). Blogs are defined by the author as a website log including both postings and responses by different authors that were received by an audience. Ironically most of the researchers echo the thoughts of Boas (2011) in the need for economy in software.

Professional Development

Professional development specific to the implementation of technology use in the classroom was found to be important for modern teachers. Researchers, Twining, Raffaghelli, Albion, and Knezek (2013) explored this in their research study. Twining et al. (2013) examined the outcomes of various methods of professional development from the EDUsummIT and the effects this development had on the implementation of 21st century skills into the teachers' classrooms. The main focus during Twining et al.'s (2013) study was to identify the most effective forms of professional development for educators when it came to technology integration. For example, given the ICT model, learning was provided that helped educators understand various teaching methods to help support 21st century student learning that helped to transform teaching rather than just extending it. It was ultimately found by Twining et al. (2013) even though professional development specific to technology instruction was incredibly

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important, a great deal of professional development was found to be through the use of ineffective activities. The overall recommendations of Twining et al. (2013) stressed the importance of communication between educators in a common working and learning culture when it came to providing more effective development opportunities including ICU, TPACK, and TWG3 learning models. Practitioners should be engaged in their learning about technology to be able to enthusiastically share this with their learning community. Solid development and communication for the integration of technology must begin during the pre-service stage of teaching. Also exploring the ways in which pre-service teachers were prepared to integrate technology into the classroom were researchers Tondeur, Braak, Sang, Voogt, Fisser, and Ottenbreit-Leftwich (2012). Tondeur et al. (2012) reviewed data on various strategies in place to prepare pre-services teachers for technology integration. The research led to the identification of twelve key themes that help to prepare pre-service teachers to integrate technology into their classrooms. Of these themes, seven stress the importance of teachers receiving this type of development and training during their pre-service training. Included in the themes listed are aligning theory and practice, using educators as role models, reflecting on attitudes towards role the role of technology, learning technology by design, collaborating with peers, scaffolding technology experiences, and moving from traditional to continuous feedback.

As the research made it clear that professional development in the area of technology integration was in high need, Hyndman conducted research (2018) to discover why teachers struggled with technology use and fostering a 21st century-centered classroom. According to the research, there were ten reasons for the struggle to integrate technology into the classroom presented by Hyndman (2018) and, interestingly enough, the challenges are similar for educators and students. The ten presented challenges are: technology is not always preferred, differing

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device capabilities and instructions, students are easily distracted, technology can affect lesson time and flow, increased need for professional development, lack of technology access, protection from risky behavior needed, not all teachers are “all in” for technology use, lack of classroom support or time, and tensions between students and teachers. To overcome these challenges, it was recommended by Hyndman (2018), similar to the findings of Tondeur et al. (2013), that the need for professional development could not be limited to a “one size fits all” solution. Instead, schools needed to foster a common school community philosophy and school-wide practice for which specific development could be offered and changes for development should be made on the macro-level before they are made for individual educators.

Not only did teachers included in this study indicate the fact that modern students did not perform higher than in previous years with given technology options, but there was a lack of technology use within the writing classroom. Researchers Lacina and Block (2012) cited two changes that could happen to help increase student success: integrate and properly utilize technology across all content areas and increase the amount of professional development specifically geared towards technology integration in the classroom. Without providing educators with development, classrooms might continue to remain stagnant and not show growth from one year to the next even with the given technologies that many districts provide. Vaughan and Beers (2016) also conducted a research study of an exploratory teacher development program for the integration of iPads within the early childhood learning environment. Although children, even young children in the early childhood learning environment, were seen to live in a world with technology at their fingertips, they were often guided to put away technological devices and were encouraged to follow a more traditional style of learning. Vaughan et al. (2016) referred to this dilemma as trying to swim against the tide. Utilizing technology to replace rather

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than to add on to current classroom practices was found to be a productive way to introduce 21st century skills into the classroom. It was reported in the study of 18 educators that 12 teachers used iPads to replace another form of parent communication, 10 teachers used iPads as a resource for information or as a visual aid, and 8 teachers used the iPad as a camera to document classroom practices.

Research by Vaughan et al. (2016) indicated technology implementation was often declined by early childhood educators and frequently technology that was included was not done in a developmentally appropriate way according to the authors. Vaughan et al.'s study proved that, in 9 of the 11 reported uses of the iPad in the classroom, more than 50% of teachers did not utilize this provided technology. Given professional development that focused on the use of iPads within the early childhood learning environment, all of the classrooms involved were not only utilizing technology within 3 weeks of the training, but they were using technology to replace an existing classroom routine rather than using technology as an add-on. Similar to the research of Vaughan and Beers (2016), researchers Hineman, Boury, and Semich (2015) explored the self-efficacy of educators in a 1:1 iPad program. The findings of this technology integration study indicated the need for a master practitioner of technology-based pedagogy for successful implementation of a 1:1 iPad program. Although many schools were becoming 1:1 with technology, not many had a full-time individual working in a position such as this. Without an individual working in a lead role, the integration of technology may not be successful or utilized appropriately or to its full potential. As stated by previous researchers and Hineman et al. (2015), it was prudent to the development of schools that communication was strong between educators, and there was agreement in philosophy with the administrators as it related to technology integration.

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A third research study that explored the effects of iPad professional development was conducted by researchers Barbour, Grzebyk, Grant, and Siko (2017). Barbour et al.'s (2017) goal was to help teachers integrate technology into their classrooms. Though it came as no surprise, Barbour et al. (2017) found educators were much more likely to use technology within their classrooms when they were proficient in using the specific technologies themselves. This was where professional development and specialized training came in. Not only is it stressed by Barbour et al. (2017) how important it was to familiarize educators with the use of iPads or another specific device, but he also found the importance of relating the device directly to the individual's classroom and give it a purpose for how it can enhance a teacher's lesson. Barbour et al. (2017) presented four secondary science teachers with iPads and a 30-minute period of development for its usage. After the given development period, one teacher felt confident to utilize the iPad as the primary method to administer a lesson. The final data showed that there was potential regarding the use of iPads or other mobile technology device use in the classrooms for both educators and students, given proper training and implementation. Reflective teaching was another specific strategy from this research that lead to positive teacher development in the area of technology integration, according to researcher Baporikar (2017). During the act of reflection, one connected new knowledge to past knowledge and experiences that, correctly implemented, could lead to meaningful new knowledge. Baporikar (2017) stated that one must work at becoming a reflective teacher along with proper training and implementation, as did Barbour et al. (2017), to enhance their teaching through change.

Following the work of Figg and Jamani (2014), a study conducted by researcher Tok (2015) aimed to explore the views of teachers when it came to technology-based writing instruction. This study includes 62 pre-service teachers who received screen-based writing

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instruction. After conducting interviews, it was found that shareability, practicality, being economic, and computer skills development were found to be the biggest advantages by at least 20 or more of the pre-service teachers in the study. Major barriers cited in this study included issues accessing a computer, trouble adapting to computer usage, and lack of computer competency skills. Even with the barriers present, it was found that the advantages still outweighed the negative effects that accompany them finding that 77.4% of the participants believed this type of instruction should continue. His research along with Figg and Jamani (2014) explored the importance of technology integration regarding how professional development was best administered. Figg et al. (2014) used a model called the TPACK-based Professional Learning Design Model (PLDM). TPACK stands for Technological Pedagogical Content Knowledge and has a focus on what is taught, how the content is delivered, and how technology is used. This model of professional learning didn't focus on teaching educators to personally utilize a technological tool or provide new technology information like many other development models. The TPACK-based PLDM worked to transform classroom practice. Teacher competence with teaching through technology could not be achieved through traditional development models. The TPACK PLDM provided a specific focus on teaching by utilizing the technology, not just teaching one how to use a specific technological device. An example of this type of development that may be transformed into classroom practice for collaborative writing included Google Drive as a feature tool. As previously mentioned by researchers Adebisi et al. (2015) and Blackwell et al. (2014), educators who had more confidence with applying technology to their instruction also had more positive attitudes towards utilizing technology in the classroom. Although the authors believed that technology integration could lead to positive

academic effects, success could not happen without professional development and teacher support.

Conclusion

Even though data and specific numbers were scarce, research highlighted the importance and benefits of technology integration into the writing classroom. Anecdotal evidence displayed the benefits for writers who struggle. The evidence showed how technology affected student engagement. Putting specific strategies and methods for technology integration into practice and professional development for educators was paramount. With proper training and support, it was found that it was possible for diverse learners with varying needs to learn within the general education setting given the use of various types of assistive technologies and the needs of the individual learner. Further research is needed on additional specific strategies and development surrounding those strategies before implementation within the writing classroom. Further research may also be needed at a given grade level or stage of learning to identify strategies more specific to the given area of need. Educator experience, attitude, and training are variables in the efficacy of any technology program.

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