Technology Integration: Teaching Elementary Deaf Student English Language Arts

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Abstract
This study examined an elementary deaf education teacher’s experiences and practices regarding the integration of technology into an English/Language Arts (ELAR) classroom. Most deaf students experience challenges acquiring and learning English as a second language. Research continues to indicate deaf students graduate high school with a fourth-grade reading level. Specifically, the study investigated how technology was used to support the development of English/Language Arts skills in deaf students based on McCrory’s model on technological integration (McCrory, 2006). McCrory’s (2016) technology integration model is used to identify the teacher knowledge and use of technology. The model includes four components: representation, information, transformation, and collaboration. Using a qualitative case study design, data was collected using interviews, surveys, and observations. The data collected focused on the teacher only and did not include the students. The analysis showed how the ELAR teacher used technology to teach deaf students in relation to the four components of McCrory’s model. Implications for K-12 teacher preparation and professional development are discussed.

Keywords: Deaf, English Language, Technology Integration
1. Introduction

Technology has become a staple of everyday life for millions of people around the world. Amid the constant use of smartphones, multimedia, computers, tablets, and the multitude of other technological equipment available to consumers, technology in its multilayered forms has become increasingly vital to everyday life. Based on the 2010 study funded by the Kaiser Foundation, children between the ages of 8-18 spend an average of 7 hours and 38 minutes each day using technological media (Rideout, Foehr, & Roberts, 2010). In today’s classroom, many have encouraged the implementation of current technologies to bridge knowledge, comprehension, and concept gaps with the added benefit of providing students with experience using technology in a world that has made it a staple of everyday life. Several studies have focused on the use of technology within the general education classroom (Cheung & Slavin, 2012; Dreyer & Nel, 2003; Warschauer, 2010) to help teach reading and writing to students.

According to Nowell’s (2014) study, ‘disruptive technologies’ in the classroom such as cell phones, tablets, and social media were used in developing learning and encouraging students to make connections to current material. Nowell found that using social media accounts, teachers and students experienced stronger relationships and connection with each other and with classroom content. Additionally, the use of mobile phones in the classroom facilitated the setting up of class events and reminders, response to various discussion points, and communicated class assignments and due dates. Veletsianos (2011) suggested that providing meaningful and relevant opportunities to interact with technology supported students to understand the concepts and content learned and the ability to apply in a real-world context.

That being said, there is very little research related to the use of technology in bridging the learning gap in the deaf education classroom. Previous research shows that the majority of deaf students graduate high school at a fourth-grade reading and writing level (Allen, 1986; Qi & Mitchell, 2007; Traxler, 2000). This gap in ability is largely due to deaf students’ limited reading and writing skills (Harris & Terletksi, 2010; Mayer, 2010; Myklebust, 1960; Qi & Mitchell, 2011). However, within the deaf education classroom, students have access to a variety of technologies and multimedia forms to help foster content and comprehension (Chinn, Gentry, & Moulton, 2004; Liu, Chou, Liu, & Yang, 2006; Mackall, P., 2001). Given that technology includes reading and writing skills and both skills have been challenging areas for deaf pupils, it would be important to examine possible ways on how to use technology to support literacy development. Hence, the purpose of this study is to examine one teacher’s practices related to the integration of technology in the elementary deaf education classroom in teaching English/Language Arts.

2. Technology Integration

Advancement in technology is noted to influence teaching and learning. Technological tools used in the classroom include but not limited to computers, laptops, cell phones, software and the Internet. The way in which these technological tools are integrated into the classroom has raised concerns leading to a need to examine what technology integration means and how technology can be effectively integrated in the classroom. Technology integration is defined in various ways (Dockstander, 1999; Hew & Brush, 2007; Holznogel, 2005; Summak,
Samancioglu, Baglibel, 2010). Dockstander (1999) defined technology integration as using technology effectively in the general content areas to allow students to learn how to apply technology skills in meaningful ways. She argued that with effective technology integration, the curriculum drive technology usage as opposed to technology driving the curriculum. Holznogel, (2005) definition concurs with Dockstander (1999) in that integrating technology is not about technology but about how and why technology is used to instruct the content. More recent work on technology integration argues that effective technology integration focuses on teachers’ technology knowledge, pedagogy knowledge, and content knowledge and how both teachers and students decide and use technology in the classroom (Hew & Brush, 2007; Summak, Samancioglu, Baglibel, 2010).

3. Technology Integration in teaching English language

The integration of technology in the general education classroom has been studied for years and multiple reports on its’ success in developing language and concepts in multiple content areas through a variety of multimedia tools and apps have been shared. Past studies have focused on the use of technology within regular education classroom to help teach reading and writing to students (Cheung & Slavin, 2012; Collins, Hwang, & Warschauer, 2014; Dreyer & Nel, 2003; Lacina, 2004; Warschauer, 2010). Collins, Hwang, and Warschauer (2014) studied the success of laptop computers and science software to help improve the academic scores of 5th grade students who were considered “at-risk” (i.e.: English Language Learners, Hispanics, and free/reduced lunch recipients). Teachers and students both identified the success of interactive videos and laboratories in providing interesting ‘hands on’ experiences, while also reinforcing the concepts they had developed (Collins, Hwang, & Warschauer, 2014). Teachers noted, specifically as it pertains to English Language Learners, that access to the visual content through technology provided students with more background knowledge that enabled connections to real world situations (Collins, Hwang, & Warschauer, 2014; Daniel & Cowan, 2012; O’Hara, Pritchard, Huang & Pella, 2013).

The use of technology provides students a friendly language learning environment that impacts their motivation to learn the language (Alamer, 2016; Lacina, 2004; Liu, Lan & Jenkins, 2014). Lacina (2004) interviewed two teachers (a 5th-12th grade ELL teacher and a 1st grade ELL teacher) on their use of technology to teach English as a Second Language (ESL). Teachers reported they used computers and video games and explained that technology provided the students with motivation to be involved in their learning. They also reported technology provided students with independence and control in their academics while encouraging self-directed learning. In Liu et al. (2014) study teachers reported that ELL students in fourth and fifth grade were motivated and developed reading skills by using iPods as as dictionaries and to play educational games that supported their reading.

Technology can also provide teachers with opportunities to support language learners in developing sociocultural connections. Hagood & Skinner (2008) used digital storytelling to develop narrative and expository texts by ‘combining multiple media’ (p.19) such as pictures, music, audio, video, and various others while teaching English language learners (ELL). Hagood and Skinner (2008) reported that technology allowed ELL students to create and develop personal stories, and provided opportunities to share stories with peers and gain
feedback, as well as garner discussion and feedback on their work. Along with this, students were able to develop and build upon foundational literacies such as story comprehension, reading fluency, oral and written vocabulary, the writing process, and decoding print. Digital narratives encouraged the students to monitor and scaffold their learning, fostering independence and accountability in their learning process.

3. Technology and Deaf Students

Within the deaf education classroom, students have access to a variety of technologies and multimedia forms such as Smart Boards, iPads/tablets, computers, smartphones, assistive technology, gaming systems, and televisions (Chinn, Gentry, & Moulton, 2004; Liu, Chou, Liu, & Yang, 2006; Mackall, P., 2001). Snoddon (2010), examined how technology was used to support American Sign Language (ASL)/visual literacy development in students in grades two, three, and five. Students developed and edited ASL identity texts which involved multiple drafts, edits, and versions which were recorded and reviewed multiple times using a video camera. Snoddon found that the use of video recording improved students’ motivation, engagement, and understanding of ASL literacy. In particular, Snoddon reported that students were more attentive and showed significant gains in their ASL learning.

Other recent studies have examined the impact of technology on deaf students’ learning. Nikolaraizi, Vekiri, and Easterbrooks (2013) explored the use of visual resources and multimedia software in developing reading comprehension and concept development. Results showed that when using this technology, students were able to improve in their comprehension of the main ideas in the text and recalled the majority of the main story elements. Wang and Paul (2011) examined the impact of technology on developing and improving word identification, word knowledge, and story comprehension among elementary deaf and hard of hearing students. Result showed that not only was there an increase in word knowledge and story comprehension, but teachers indicated an increase in students’ motivation and engagement.

4. Research Question

The purpose of this study was to explore and analyze the use of technology in relation to teaching English/Language Arts to elementary deaf students. The primary question which guided the study was:

How does an elementary ELAR teacher integrate technology into a classroom with students who are deaf?

5. Theoretical Framework

There are multiple models and framework that are often used to examine teachers’ technology integration and Technological Pedagogical Content Knowledge (TPACK) is one of the frameworks that have been used in research to examine teachers’ technology integration (Abbitt & Abbitt, 2011; Hsu, 2012; Mishra & Koehler, 2006). TPACK focuses on the relationship between technology, pedagogy and content knowledge and the knowledge teachers need to effectively integrate technologies into their teaching. According to Shulman’s (1986) TPACK consists of three types of knowledge: technological knowledge (TK), content
knowledge (CK), and pedagogical knowledge (PK). TK focuses on the teachers’ knowledge and application of technological tools in their classrooms. CK focuses on teachers’ knowledge of the content matter they teach while PK involves knowledge of their students, knowledge of various instructional and classroom management strategies, and knowledge of assessment.

Previous research identified TPACK as a significant model in integration of technology in the classroom because it was developed to attend to specific needs and is influenced by contextual factors including students’ characteristics, teachers’ beliefs and practices, available resources and the learning environment (Angeli & Valanides, 2005; Ashe & Bibi, 2011; Hofer & Swan, 2006; McCrory, 2008). In support of TPACK McCrory (2016) developed a technology integration model that includes four components: representation, information, transformation, and collaboration. McCrory’s model on technological integration (2006) was selected as the most appropriate theoretical model for this study because the focus of the study was to identify the teacher knowledge and use of technology in teaching a specific group of students (deaf and hard of hearing students) in a specific learning context (mainstream classroom).

The four components in the model that guided the study are briefly described below:

i. Representation

Representation focuses on a teacher using technology to provide ‘representations of ideas and processes that are difficult to characterize without technology’. Online dissections and simulations of materials within science classrooms are examples of how this might appear within the classroom setting.

ii. Information

Information presents itself when the teacher gives students ‘access to data and content on the Internet’ or web-related servers. The appearance of pre-made data sets and online databases containing information for students to use for research or classroom activities is an example of how this can be integrated into the classroom.

iii. Transformation

Transformation relates to a teacher ‘changing the nature of tasks’ the students will complete, making work and class run in a more efficient manner. Examples of this can be allowing students to complete and collect data using an online simulator rather than actually completing the data collection in class in order to help ensure proficiency and accuracy.

iv. Collaboration

Collaboration relates to providing and ‘facilitating communication with peers and experts’ to encourage and develop student comprehension and ability. Examples of this can be discussion boards, online internet chats, and blogs that encourage students to collaborate and work together through peer review, peer editing, and evaluation.

Based on this theory, the current study examined how the ELAR teacher for students who are deaf used technology to present and discuss ideas, attend to content information, design and assign students’ assignments and promote peer interaction during classroom instruction.
Further, the framework guided the researchers to identify and analyze the purpose and intention behind the teachers’ technology use to further instruction.

6. Methodology

A case study research design was used to collect and analyze data to better understand the deaf education teacher’s experiences using technology in an English language arts elementary class. Yin (2012) defined a qualitative case study as one that can be used to investigate an existing phenomenon in depth and within its real-life context. The authors chose a case study because a case study is useful in providing answers to ‘How?’ and ‘Why?’ questions, and to describe events in which they have little or no control hence, a useful tool for preliminary, exploratory, descriptive or explanatory research (Yin, 1994). Currently, there is no research on integration of technology to teach ELAR to deaf children and thus the current study is an exploratory descriptive study.

7. Participant

The participant selection was determined by the research purpose, questions, and theoretical context. Other constrains that impacted the selection include participant accessibility resources to support travel and other data collection and analysis costs, and the time available. The participant in this study was purposively selected because of her credentials for teaching, proficiency in both English and ASL, and teaching experience with deaf students. Additionally, the teacher was chosen because she possessed three key knowledge components required for technology integration which include technology knowledge, content knowledge and pedagogy knowledge.

The profile of the participating teacher is as follows; the teacher was given a pseudonym to maintain anonymity. Ms. MacGregor is an elementary, Deaf education teacher, and highly qualified to teach deaf students. She has been teaching in the field of deaf education for approximately five years and has both a bachelor’s and a master’s degree in Deaf Education from an accredited university in the United States. Along with this, Ms. MacGregor holds certifications in K-6th grade education, English/Language Arts, and American Sign Language. Also, Ms. MacGregor has knowledge and uses various educational technologies in her classroom. During the study, Ms. MacGregor taught third, fourth, and fifth grade ELAR in a self-contained classroom for the deaf. The current study focused on Ms. MacGregor and her eight, fifth-grade students.

8. Data Collection

Using a qualitative case study design, data was collected using a survey questionnaire, observations, an interview, and the primary researcher's journal. The survey questionnaire focused on the participant’s background information including training, teaching experience within the field of deaf education, and experience with technology in the classroom. Classroom observations took place in specific times scheduled in advance with Ms. MacGregor in her classroom. Following the observations, a follow-up interview was conducted with Ms. MacGregor. The researchers developed an interview protocol with less structured questions based on each of the components of the McCrory’s model of technology Integration (McCrory,
2006) to ensure the questions covered all four components. The interview lasted about forty minutes. The primary researcher kept detailed field notes on the classroom observations.

9. Data analysis

The researcher used the coding procedures outlined in Corbin and Strauss’s Grounded Theory (1990) to analyze the data collected. In order to code the data, the researcher utilized “Open Coding” which is ‘the interpretive process by which data is broken down analytically’ (p. 12). The researcher segmented and divided the collected data into similar groupings and created preliminary categories of information about the phenomenon reflected. This helped the researcher in identifying overarching themes that correlated to the four components on technology integration in ELAR classrooms. Utilizing the qualitative study evaluative criteria developed by Lincoln and Guba (1985) the researcher ensured that the data was deemed trustworthy in relation to four specific categories: credibility, transferability, dependability, and confirmability.

10. Findings

The findings are presented according to McCrory’s (2006) model of technology integration in the classroom with a focus on its four components; representation, information, transformation, and collaboration.

11. Representation

McCrory states that ‘representation’ occurs when the teacher uses technology to present ‘ideas and processes that are difficult to characterize without technology’. During the interview, Ms. MacGregor explained that “deaf students are very visual” and because of this, the use of technology to support vocabulary can be categorized as a way of representing information and ideas to deaf students that would be complicated for them to comprehend through the use of paper and pencil alone.

In multiple instances during classroom observations and throughout the interview, the use of technology as a way to support vocabulary development and skills was identified. Ms. MacGregor praised the use of the Smart Board as it provided opportunities for her to point out specific words for her students to focus on. She explained, “I use the markers to show bridges—that is when two words have just one sign…an example would be ‘last week’, you would put a bridge around ‘last week’, and that means it has just one sign”. During classroom observations, the use of technology for representation was noted as Ms. MacGregor highlighted bridges such as ‘lift her head’, ‘make it’, and ‘change into’ to support students’ reading. Along with this, the teacher was observed using technology to help the students determine the signs for printed words.

Not only did Ms. MacGregor use this technology for vocabulary development, but also for spelling practice. Ms. MacGregor asked the students to identify a word and, when they gave their signed answers, she wrote these responses on the Smart Board. This activity was done in order to compare them with the new vocabulary word, pointing out spelling differences and similarities in a way that both served as a review of vocabulary that had been previously learned as well as a lesson on spelling differences in English and the meanings behind these differences.
Ms. MacGregor was observed frequently using the internet, Smart board, and other resources to provide students with visuals in order to increase their comprehension. In one such instance, a student was confused by what a leaf was. Ms. MacGregor immediately pulled up Google, searched for the word ‘leaf’, and showed multiple images depicting a leaf. At this, all the students responded positively and began sharing experiences or background knowledge related to what a leaf was.

11. Information

Technology was used by the teacher to provide content on the Internet containing information for students to use for classroom activities in practicing language skills. In Ms. MacGregor’s class, iPads and laptops were often used for student centers. During classroom observations, iPads were frequently used by students to develop ASL stories, discuss these stories with peers, and take comprehension quizzes on their understanding of the story as a whole. Laptops were also used by the students during centers to take reading (AR) quizzes, to access e-readers, or to play online vocabulary and spelling games on interactive learning websites such as Weebly and BrainPop. Technology was also used by students to search for meaning of words and phrases.

12. Transformation

Transformation relates to a teacher ‘changing the nature of tasks’ the students will complete, making their work and the overall classroom run in a more efficient manner. During the interview sessions, Ms. MacGregor frequently mentioned that technology was a motivation for her students to meet classroom expectations and increased students’ involvement and engagement. She provided the students with these opportunities to show their ability to be responsible and accountable with the various technology used in the classroom. She said “they (the students) realized they’re capable of meeting the expectations which is very important to instill in these students.” She further explained that students realized that the “technology is not present to be used simply for playing games or for taking advantage, but instead they are supposed to be learning and to be working hard. Hence as they work to meet those expectations, they develop responsibility and accountability.”

Ms. MacGregor explained that using technology can make education interesting, interactive, and visual. She reported, “Yes, these students are playing games on iPads and laptops, but these games are reading incorporated games, related to the book we’re reading in class, to what we’re writing about, but the kids don’t think of it like that, they think, ‘Oh this is so cool!’”. Ms. MacGregor explained that, by allowing students to use technology as a way to complete their work, the task itself is changed in a way that provided motivation and enjoyment for the students and, they are more apt to “do it and do it right the first time”.

13. Collaboration

Collaboration relates to providing and ‘facilitating communication with peers and experts’ to encourage and develop student comprehension and ability. The use of technology as a motivator encourages collaboration between the students, the teacher, and the technology. During the in-depth interview, Ms. MacGregor often spoke of the Smart Board and how it can
be used “for independent group work for centers. I make games and the students…project it on the Smart Board” allowing the students to begin their work using the game provided.

During classroom observations, the Smart Board was used daily for student centers as students, in groups of two, were allowed to pick a review game to play that would help them to practice and develop their reading comprehension and vocabulary skills. These games included review and practice with spelling, identification of various vocabulary words and signs, sorting words into parts of speech, as well as answering reading comprehension questions based on books previously read in the classroom. The use of technology in student centers allowed the students to collaborate and work with one another to gain a better understanding of the material and concepts being targeted.

14. Limitations

The limitations of this case study are that all data collection was done in one school, with one teacher, in one classroom and in one content area, English. Also, the data focused on an elementary self-contained deaf education classroom in a mainstream program.

15. Conclusions and Recommendations

McCorry’s model on technological integration (2006) was used to examine the classroom practice of an ELAR teacher using technology to teach deaf students. All four components of the framework (representation, information, transformation, and collaboration) were observed and reported. Based on the definition of technology integration which is not just about knowledge and use of technologies but more about how and why technology is used to instruct the content (Dockstander, 1999; Hew & Brush, 2007; Holznogel, 2005; Summak, Samancioglu, Baglibel, 2010). The current study data indicated that Ms. MacGregor was not only aware of the various types of educational technology available for classroom use, but that within the classroom, specific technologies were integrated to support student learning and achievement.

Ms. Gregory demonstrated technology knowledge in use of various educational technologies and made decision which technologies would be used with her students who are visual learners. Four types of technology were observed and reported during the interviews including the Smart Board, projector, iPad, and laptops. Previous studies have shown Smart Board use in most learning environments supports collaborative learning (McCabe & Emery, 2003) as it ‘supports several different learning styles – visual-spatial, auditory, and kinesthetic’ (Preston & Mowbray, 2008). The Smart Board helped to develop student thinking as it was observed that students began ‘exploring ideas as they talked, clarifying and shaping thinking or trying out ideas while talking to others’ (Murcia & Sheffield, 2010). Beal-Alvarez & Cannon (2015), argued that technology use was instrumental for deaf students who are inherently visual-spatial learners because technology “allows a combined visual and verbal presentation of information” (p. 4).

The current study findings agree with Beal-alvarez and Cannon (2018) because English language is a sound based phonological language (Hogan, Catts, & Little, 2005) and most deaf students who use ASL use a different phonology of signed languages (Aparicio Gounot, Demont & Metz-Lutz, 2007; Leybaert, 2000; Mayberry, del Giudice, Lieberman, 2011;Morford, Wilkinson, Villwock, Piñar, & Kroll, 2011). Using technology enabled the teacher to present both sound based phonology of English and visual based phonology of ASL.
One key aspect of technology integration is the development of students’ knowledge and use of technology in learning and in real life in order to be independent learners (Hew & Brush, 2007; Summak, Samancioglu, Baglibel, 2010). Similar to current study findings, Light and Pierson (2012a) observed that the use of laptops in learning increased classroom management efficiency and gave students ownership of their learning, indicating a transformation in how learning occurred. Also, laptops were reported to increase access to educational resources and increased independent student research allowing for information access, the second component in the McCrory technology integration model (Light & Pierson, 2012a; McCrory, 2006). Akin to previous studies, the use of laptops in the classroom changed the dynamic between students and teachers, allowing for a more personal and interactive educational setting and offered more frequent feedback and communication between teachers, students, and parents (Light & Pierson, 2012a, 2012b).

The use of iPads in the current study transformed how learning occurred based on McCrory’s framework. The iPads provided students with alternatives to conduct various learning tasks individually or collaboratively.

For instance, students were able to access reading and comprehension tasks through games or e-reading. Similarly, Sackstein, Spark, & Jenkins (2015) reported the effectiveness of e-books and tablets in the development of comprehension and support of reading speed.

Based on the findings of this study, technology integration and use in relation to teaching English/Language Arts to deaf students suggests a positive correlation to supporting deaf students’ English literacy skills. Integration of technology supported comprehension of ELAR concepts and development of skills through representation, as well as transformed ELAR learning by presenting the task in various forms. The use of technology in ELAR also showed that teachers can support students to access information independently, allowing students to own their learning process. Finally, technology integration facilitated collaborative activities that encouraged scaffolding of ELAR and problem-solving skills between deaf students.

In order to use technology to decrease the gap in literacy skills between deaf and hearing students in K-12 programs, the need for professional development for teachers of the deaf to develop skills to improve their presentation is required. In addition, it is important that teacher preparation programs educate new teachers on the use of technology in the classroom. Since most deaf students are English Language Learners (ELL) and some are ASL/English bilinguals, providing teachers-in-training with the knowledge and skills necessary to use the four components of the McCrory’s framework may improve ELAR skills for deaf students. The training would also ensure that teachers are comfortable and confident with the various educational technology available to them.

16. Recommendations for Future Research

While this study represents a start in relation to understanding and developing research related to the integration and use of technology to teach ELAR to deaf students, further research is needed. First, a future study documenting and comparing the beliefs, knowledge and practices of multiple teachers related to technology use in the ELAR deaf education classroom would yield more data and provide researchers with the opportunity to compare the various types of
technology used, as well as their ability to ensure positive outcomes in comprehension, development, and engagement.

Second, a case study determining the beliefs of students related to the integration and use of technology in the classroom, as well as its perceived benefits, challenges, and uses, would provide researchers with valuable knowledge related to the motivation and engagement of students with technology in an educational setting as compared to the social use of technology. Also, it would be beneficial for future researchers to examine the impact of technology on comprehension by developing a study that could determine how the integration and use of technology helped to increase comprehension and vocabulary skills based on assessment results and classroom data collection. Lastly, while this study focused on the benefit of technology as a way to support ELAR, future studies should focus specifically on integration of technology to support and develop the writing skills of deaf students, an area rarely researched.

Compliance with Ethical Standards:

Conflict of Interest:

The authors declare that they have no conflict of interest.

Ethical Approval and Informed Consent:

The institutional review board of Lamar University approved the study, and the participant consented to her participation in the study. The participant was provided opportunity to end her participation in this research study at any time. Additionally, the participant was provided with Lamar University Institutional Review Board contacts to call for information regarding her rights as a research participant. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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