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Expanding Family Literacy through Video Game Playographies

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Abstract:

The aim of this article is to broaden traditional views of what is considered home and family literacy through the exploration of video game connections to literacy learning. Specifically, this autoethnographic study examines the researchers' personal play biographies or "playographies" as they relate to video game experiences. Through considered reflection of individual playographies, each researcher noted a shift in perception through their interactions with video games as teachers, parents, researchers, and gamers. As a result, each felt they were able to further appreciate and understand literacy learning connections through video game play at home and with family.

Keywords:

literacy, video games, home literacy, family literacy, playography

Introduction

James Gee's gaming biography sparked a line of intrigue and inquiry for understanding learning and literacy through video game play (2007, 2012, 2017). Through observing his son, Sam, and engaging in his own video gameplay, he identified 36 principles of learning incorporated and leveraged by good video game design. His experiences with games such as *The New Adventures of the Time Machine* and *Deus Ex* were also the foundations for his well-known research focused on situated cognition, New Literacy Studies, and connectionism, a pattern-recognition view of the mind (Gee, 2007).

Other researchers have made discoveries about video games and gamers by examining their own play biographies, or "playographies", as well as those of others (Mitgutsch, 2011; Rice, 2014). Although Rice (2014) was the first to use the term "playographies", she did it in reference to Mitgutsch's narrative inquiry into play histories. He found players developed meaningful learning patterns that connect and transfer the virtual worlds of games to the realities of lived experiences in the physical world. Considering the influence of his own playography on his learning, Mitgutsch interviewed young adults about their play histories finding meaningful learning patterns beginning as early as ages four years to six years. Although each playography is unique, patterns emerged that included:

- interacting with others
- developing gaming strategies
- repeating game play to perfect levels.

Rice (2014), who acknowledged her limited game playing history, recognized the pull, or enchantment, of games and used her own playography and the playographies of her students to better understand how she might leverage the use of video games in her middle school English class.

In the authors' multiple roles as teachers, parents, teacher educators and school leaders, their playographies have shaped their thinking about video games' influence on literacy. They have witnessed and experienced firsthand video games as home and family literacy. Furthermore, they believe that video games, specifically narrative and role playing games, should not be dismissed as a distraction, rather they should be valued as multimodal texts that can be a support by and for users' culture and context. Therefore, the goal of this article is to offer a deeper understanding of how video games can be useful in navigating and supporting literacy learning as well as broadening traditional views of what is considered home and family literacy.

Defining Home and Family Literacies

While formal literacy learning around books and digital media happens in classrooms, research from the past three decades has established strong relationships between *home literacy environment* (HLE) and success in school-based literacy (Puglisi, Hulme, Hamilton, & Snowling, 2017). The HLE describes the literacy interactions and encounters with resources and attitudes about literacy that children experience in their homes in active ways, such as interacting with print and passive ways such as observing the behaviors and attitudes of others in the home (Bracken & Fischel, 2008; Burgess, Hecht, & Lonigan, 2002). Hamilton, Hayiou-Thomas, Hulme, and Snowling (2016) state that home-based literacy "interactions provide a social context for children's earliest encounters with the printed word, and much research on the HLE assumes an important role for experienced others (most often parents) in children's early literacy development" (p. 1).

Family literacies go beyond books and reading activities and well beyond the traditional tools utilized by educators in the K-12 setting. Souto-Manning and Yoon (2018) share that "family literacy practices may include singing hymnals from memory as an intergenerational practice" (p. 85). Cultural and family ways of communication and expressions surround the

children as they are growing up and influence literacy development. However, these critical first literacies that are tied to the family values are often undervalued by the traditional education system. When educators allow the family culture to have a place in the literacy learning process at school, literacy engagement and focus may increase.

Redefining Home and Family Literacy

Interestingly in the most recent *Handbook of Family Literacy* (Wasik, 2012) there is not a single chapter devoted to either technology or video games as part of the family literacy fabric. One independent research center that conducts ongoing research on children and media, produced their first reports on touch screens and games a month prior to the launch of the iPad in 2010 (Chiong & Shuler, 2010; Welling & Levine, 2010). Soon after these reports, the popular press referred to toddlers and preschoolers as “the touch-screen generation” (Rosin, 2013) pointing to the advent of smartphones in 2007 and the introduction of the iPad in 2010 as pivot points.

According to Souto-Manning and Yoon (2018) “we engage in expanding the concept of home literacies to the ways in which language and communicative practices come to life in home and across interactions with family members” (p. 86). Video games often have communication and interaction embedded into the game to provide key focus on family literacies. Parents and guardians are children’s first teachers and can influence the level of print or digital reading materials that are in the home. These first teachers also have the power to influence the level of normalcy attached to video games for the children. Gaming families may have video gameplay throughout the week and the vocabulary and literacy exposure for the children in these homes can be seen by educators from kindergarten through high school (Haas, 2012). As teachers and educational researchers, the authors reflected on observed changes in their own families related to video game play, their understanding of home and family literacies, their initial biases toward video game play, and their introduction to looking at

player histories, or playographies, as a lens for exploring new understandings of video games as part of home and family literacies.

Method: Examining Playographies

Over the years three of the authors' experiences with video games as both observers of their own children, their students, and as players themselves reshaped their thinking about video games, literacy, and learning, and specifically, home literacy experiences. While their method is primarily collaborative autobiography, it was inspired by Mitgutsch's (2011) qualitative work exploring the player histories of seven university students and looking for meaningful learning patterns. This study also utilized a small purposive and homogenous sample of individuals with similar characteristics and traits (Patton 1990), which offers the potential opportunity for further research using a multistage purposive sample. The resulting design is an application of collaborative autoethnography. Collaborative autoethnographic research teams typically consist of two to four researchers examining a social phenomenon together through their autobiographical data. This type of analysis recognizes the importance of ‘data on the self’ (Chang, Ngunjiri, and Hernandez, 2012, p. 18) and uses concurrent autobiographical ethnographies in the context of a collaborative group. The authors focused these autobiographical writings on their player histories, or playographies, written independently of each other.

Next the authors examined their own and each other’s playographies looking for commonalities and differences while searching for meaning and patterns in relation to literacy and learning. Their initial analysis was independent of each other. However, as they found interesting insights and additional questions of a particular story or playography events, discussions occurred. This caused additional writings as they asked questions of each other’s writing and stories. They came together for comparison and combining codes and working

toward consensus on themes looking for intersections of traditional literacies as well as being open to new possibilities of home literacies.

Leslie's Playography

Leslie, who is an educator and parent, was asked to play *World of Warcraft* with her adult niece who lives several states away. Having immediate reservations about playing a game whose very name sounded violent was unappealing, Author 1's desire to bond with her niece overshadowed her misgivings. Unaware of how to play, her niece scaffolded the experience by sitting next to her as she learned how to create a character, join a guild, complete quests, and participate in the auction house. Continuing to scaffold the gaming experience, Leslie's niece would often talk her through the experience such as battle grounds and raids via phone conversations, in-game messaging, and later in-game voice chats. As she began to enjoy gaming and become more proficient, her children developed an interest in playing as well. Previously against having her children involved in a game like *World of Warcraft,* she began to understand the embedded educational opportunities and joy associated with the game. Each child seemed to enjoy the video game in a unique way. Her son liked testing his strategy and skill against other players in one-on-one and group scenarios; her oldest daughter liked the challenge, exploration, the adventure of the questing system, as well as the social interaction of meeting and chatting with other players online; while her youngest daughter loved to continuously create new characters, collect virtual pets, and change her character's hair color and style. Leslie's husband was the last family member to join, and became a huge fan of the game very quickly. As a family, they established rules around gaming much like those already established within their home involving other activities incorporating technology and screens. Additionally, they created a family guild within the video game that allowed the children to play online while always being connected to a trusted friend or family member.

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Living in distant geographical locations in the U.S., Leslie, her husband, and three children began having scheduled family game nights with cousins in the Midwest and a grandmother in the northern United States. This family time allowed members to go on adventures, build relationships, and solve problems in unique and engaging ways. Family game night became more than just a board game across the table, rather it became a cross-cultural, multigenerational shared experience across worlds. These experiences developed literacy interests for her children that acted as a "pull" into educational discovery rather than the "push" they were receiving in the school setting.

Sheri's Playography

While teaching in her third and fourth grade multiage classroom, Sheri recounts the following experience. During a class discussion on food chains, the topic of decomposing was introduced. While explaining the process of decomposing, she mentioned her own backyard composting. One student said, "Oh, that's like in *Runescape* when we compost veggies...." and other gamers chimed in confirming. This was a turning point in her thinking about the value of video games. Considering this knowledgeable discussion on composting from her suburban students that brought schema to the science content under study, she was intrigued about the potential of this virtual world game. Like many educators, she initially saw little value in gaming and was concerned that this play usurped time that could be spent reading or more physical play. This dismissive view could be rooted in her early playography of video games. The summer before heading off to college in 1977, some friends then played the 2-year-old home version of Atari's arcade game, *Pong*. The simple, two-player ping-pong paddle board game was fun enough for a social gathering, but not compelling enough to miss once she arrived at her college campus.

Another experience that pushed this change in thinking about video games occurred near the same time she mused over *Runescape* as she watched her then 12-year-old son play

The Legend of Zelda. When he became stuck at a particular level, he would run to the computer to search for "cheats," read a screen full of dense text, and then run back to the game to make his next more knowledgeable play. Watching her own son and listening to her gaming students, compelled her to re-enter the world of video games in this more storied genre, in which boys, in her case, were spending lots of their out-of-school time. Since *Runescape* is a free popular online video game, she decided to engage in play with her students. As a novice, she relied on both her students and her son to guide her through learning how to navigate this virtual world. Through her experiences with observing her son, listening to and engaging in play with son and her students, she learned more about the amount of reading done within RPGs and outside of them to build more expertise in gameplay. She also experienced reading the video game world to discover the material intelligence of objects within these enchanting places through playing that iPad game, *Lily.* She learned that clicking in the environment offered clues and commodities that helped move forward in the game. This gaming experience helped her be more prepared when she later played *Wizard101* with her grandsons and *World of Warcraft* with Leslie and her younger daughter. It also helped her form stronger social connections with game-playing students in acknowledging their play as valuable and too often draw them into traditional literacies by making academic connections with their game play.

Julie's Playography

In fact, the complex pedagogical practices of video game play was Julie's turning point in her perceptions of the value of gaming. In one of her doctoral courses on advanced instructional design, a part of the coursework was devoted to studying the learning principles embedded in video games. To begin the study, she spent some time in class playing several different games. She came home and began talking to her children about games, what motivated them to play, and how she could enter the gaming world. They willingly spent hours teaching over her

shoulder and playing next to her. From this gameplay, she discovered the self-directed, deep thinking and learning that is fostered when children's curiosity is piqued.

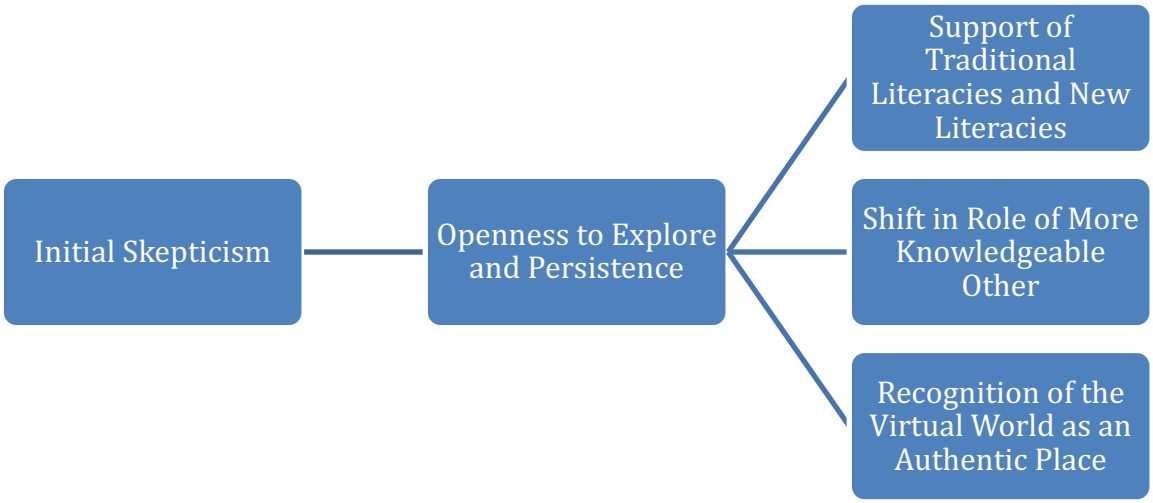
Julie began her gameplay with immersive, simulation games. In her coursework, she played *Rise of Nations* on the computer. She also quickly began playing *The Sims*. As she began thinking about games with a new understanding of their allure for children, she also began to study and evaluate the pedagogical aspects of those games that made them so compelling. Believing in the idea that there are "good" video games and "bad" video games, she steered herself and her children toward the good games - the ones that had little to no violence and had other redeeming qualities. The family purchased a Wii gaming system and *Wii Sports* was a favorite along with *Guitar Hero* and *Minecraft* on the computer was a huge hit in her house. She was incredibly surprised when reading Gee's (2007) work and the way he defended violent video games. While it was not time for her own children to embrace first-person shooter games, she developed an understanding and appreciation for what all video games have to offer educators, if they take the time to explore.

As her children grew, different video games came and went. She asked her children many times over the years to help her learn games, to evaluate the games for their affordances, and to further understand the games' appeal. She also drew her children in when she was evaluating a game for her students. This collaboration continues to happen, and as recently as this past summer, she convinced her adult son to play *Animal Crossing* with her so she could evaluate it for her students' use. She still plays some games periodically, but now most are small iPad games rather than immersive games, mostly due to her time constraints. In reflecting on when her study of video games began, it was when the children had become independent readers and the time that she cherished reading to them was all but gone. However, games opened a new avenue for shared family experiences that is still present in her life.

Findings: Playographies and Shifted Perspectives

Examining playography experiences provided the authors with opportunities to examine individual bias and educational literacy experiences embedded within video games. Each playography caused shifts in perspectives of video games and their value in HLE. Across each of the three playographies, three patterns emerged: the recognition of traditional literacies and new literacies, experiences of children as more knowledgeable others, and recognition of the virtual world as an authentic place (Figure 1).

Figure 1: *Authors' Shifts in Perspectives of Video Games Literacy Value and Findings*



Recognizing traditional literacies and new literacies

According to the National Literacy Trust (2020), "35% of young people who play video games believe playing video games makes them a better reader" (para. 4). Digital game-based learning lends itself to greater engagement than more traditional material such as worksheets and textbooks. Kalton (2019) found reluctant readers often have ineffective strategies for tracking and scanning print. However, "in digital games, text is much easier to visually perceive and track. Instead of having multiple paragraphs on a page without the benefit of illustration,

there is only a sentence or two on screen at a time" (para. 12). Due to these factors, video games continue to offer literacy support for students, especially struggling or reluctant readers. While educators' understanding of the value and usefulness of video games as learning tools can support in-school literacies, parents or guardians also need to adopt an understanding to support these out-of-school literacies. Livingstone (2018) outlined several methods for parents or guardians to increase their understanding of the video games that their children are playing. Parents can deepen their understanding by "talking to their children who are playing games, and listening to their answers offers an excellent resource. This can lead to parents being present during game time to see first-hand what their child is doing" (para. 12). Simply understanding the story line of games and exploring their children's choices for play can bring parents and guardians into the conversation; this further supports literacy development and engagement in the home.

Experiencing a shift in the more knowledgeable other in ZPD

Each author's playography illustrates that it took only an openness to games to begin and some persistence to engage. As Gee (2007) recounts and the authors' experiences taught them, video games are not easy. The children in each situation willingly scaffolded the authors' learning. Indeed, they relished their role as the more knowledgeable other, teaching the authors the ins and outs of their literacy in the authors' zones of proximal development (Vygotsky, 1978). Litowitz (1993) challenged the adult centric thinking behind the zone of proximal development. Her challenge does not mean any person, regardless of age, should be viewed as a more knowledgeable other; the challenge is deeper. She contends that when two people come together, it is not a transaction in which one more knowledgeable person gives and the less knowledgeable person receives. Rather, when two come together they create an experience that is a part of both of them and through that shared experience learning happens

for both people. It is this view of the zone of proximal development that most captures the learning the authors experienced while gaming with their children.

Recognizing Virtual Worlds as Authentic Spaces

While each author acted as informed consumers and gatekeepers for their families' time, access, and independence around video gameplay, they were able to recognize cyberspace as real space, a collective experiential space, with options for connecting, decision-making, and agency. Interactions within virtual worlds were full of literacy opportunities via a variety of communication modes including aural, gestural, linguistic, spatial, and visual. However, these spaces differed from traditional spaces by maintaining themselves safe places to fail. Failure was regarded as an integral part of the learning process and supported players to achieve higher levels. Leslie's family interacted in this virtual space in ways not geographically possible, yet they had common experiences, collaborations, and memories that they still refer to today. Sheri's students knew composting, not from a backyard garden space but from a virtual world that taught them about the physical world in a simulation that brought relevant examples to a content area discussion in a physical classroom. Challenging the notion that virtual worlds are not in fact the real world. Di Cesare, Harwood, and Rowsell (2016) state that digital spaces, such as those found in video games, lend themselves to the idea of a third space where "thinking can be conceived of as the intersections created by online and offline play experiences" (p. 93). Therefore, these real world opportunities through video games allowed the authors to shift their perspectives and embrace the idea that video game play can be a true and valuable form of family literacy and offer insights from the virtual world to the physical world.

Discussion

According to the Entertainment Software Association (2020) three-quarters of United States households have at least one person who plays video games for at least an hour a week for a total of over 214 million regular game players. Of parents whose children play video

games, 92% of them “pay attention” to the games their children play, 87% are aware of the games’ rating, and 48% engage in video game play with their children for at least an hour per week. These statistics show that video gaming is no longer part of a counter- or sub- culture, rather it is part of the mainstream.

Gee (2021) draws connections between traditional book and print-based literacies. Both are forms of literacy that involve getting and creating meaning. Video games also have unique properties that distinguish them from books, and vice versa (Gee, 2012). While the games described often include a story arc as the context, they are designed as problems to solve in which the game player is co-authoring the story through their decision-making process. This type of interaction leads to more design thinking in which gamers may modify or redesign games as they become more skilled. The video gameplay that the authors describe is a social experience in which children are playing with friends or family.

New technologies are typically suspect as they enter cultural norms. Television was suspect as it was feared to replace reading and was seen as a more passive act. Video games are often stereotypically linked to violence, when many are collaborative and have been linked to prosocial behavior (Kovess-Masfety, et al., 2016). Role playing games with familiar characters, such as *Aladdin* and *The Little Mermaid*, put young players in an active decision making role when engaging with a multimedia world that is responsive to their actions (Goode & Vasinda, 2021). Cooperative games, such as *Animal Crossing* and *Bloxburg*, provide virtual online opportunities for building virtual worlds with friends, much like children have done with blocks and toys in the physical world. There are “local” options for this same type of play in which games, such as *Little Big Planet*, are played on a game system with other family members or friends and the exploration and building of worlds is played and stored locally within the game system, not online. The sense of exploration and agency contributes to the building of background knowledge students can bring to school-based literacies.

Books and video games both also involve mentoring as part of home and family literacy. We posit that the mentoring can be reciprocal in which parents may help children with texts in video games, and, as illustrated in each playography, children may have something to offer adults in terms of logistics related to making video gaming moves and material intelligence of the environment. Additionally, children who grow up in gaming families, may have mentors in older siblings and parents who are gamers (Goode & Vasinda, 2021). As Julie noted, when her children became more independent and her time for read alouds came to a close, she felt drawn to join this new literacy experience, and although her children mentored her in game play, the talk that is part of the mentoring and game playing processes is key.

Gee (2012) considers the critical role of talk as the most important variable in home literacy and its positive connection to future literacy.

> Just as for books, talking and interaction with and mentoring from adults early in life is crucial for setting games in the context of critical thinking, making ties to content knowledge and the world, problem solving, and innovative thinking. Without such a foundation, both books and games can become passive media, a form of consumption without the production of deep knowledge and the development of skills important for the future (p. 419).

Newman and Celano (2006, 2012) made similar discoveries in their ten-year study of equal access to technology in high and low income neighborhoods in Philadelphia. It was the interactions between children and caring adults that made the experiences rich and meaningful. The disparities of access and to access with careful mentoring has the potential to lead to a wider gap in the digital divide and to what researchers term the Matthew Effect (Gee, 2012; Stanovich, 1986) in which children who have success in reading, tend to read more while those who experience difficulty read less, thus the *rich become richer while the poor become poorer*. Gee (2012) believes this extends to game play, too.

Conclusions

Many educators and caregivers continue to focus on ways to embed literacy into all areas of instruction as well as real-life experiences. This autoethnographic look at playographies gave the researchers multiple lenses from which to consider video games and their place in home and family literacies. The authors viewed this type of digital play from the perspectives of parents, teachers, researchers, and game players. Their views on video games changed from each of those perspectives, as well. What was once viewed as a questionable past-time that usurped opportunities to engage with paper-based texts and literacy opportunities, was changed to the recognition and appreciation of opportunities for new literacies that support traditional literacies.

According to Salonius-Pasternak and Gelfond (2005) “[e]lectronic play is the first qualitatively different form of play that has been introduced in at least several hundred years” (p. 6). This different form of play has become more apparent and important since the onset of the global pandemic. During this unique time in history, engaged, playful, technology-based learning offers students opportunities to grow in a safe and healthy environment. Kervin (2016) suggests that “[d]igital play sets a child up to engage with literacy processes because the child is deeply involved in the play situation” (p. 72).

Cooperative and role-playing video games support narrative structures and build valuable background knowledge, facilitate communication and social interaction becoming new funds of knowledge in fun and engaging ways. When parents and educators understand and recognize this, they can leverage student interests while supporting literacy growth as well as engaging reluctant readers and writers. Examining their own playographies helped each author further appreciate literacy learning through play with family and at home. Perhaps those reading this work will consider joining in the quest to embrace all forms of literacy and engagement.

References

Bracken, S. S. & Fischel, J. E. (2008). Family reading behavior and early literacy skills in preschool children from low-income backgrounds. *Early Education & Development*, 19(1), 45–67. DOI: 10.1080/10409280701838835

Burgess S. R., Hecht S. A., & Lonigan C. J. (2002). Relations of the home literacy environment (HLE) to the development of reading-related abilities: A one-year longitudinal study. *Reading Research Quarterly*, 37(4), 408–426. DOI: https://doi.org/10.1598/RRQ.37.4.4

Chang, H., Ngunjiri, F., and Hernandez, K. (2012). *Collaborative autoethnography: Developing qualitative inquiry*. Left Coast Press.

Chiong, C. & Shuler, C. (2010). *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devises and apps*. The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from https://joanganzcooneycenter.org/wp-content/uploads/2010/10/learningapps_final_110410.pdf

Di Cesare, D. M., Harwood, D., & Rowsell, J. (2015). *It is real colouring?: Mapping children's im/material thinking in a digital world*. DOI: https://doi.org/10.4018/978-1-4666-8310-5.ch004

Entertainment Software Association. (2020). *2020 essential facts: About the video game industry*. Retrieved October 28, 2020 from https://www.theesa.com/wp-content/uploads/2020/07/Final-Edited-2020-ESA_Essential_facts.pdf

Gee, J. (2007). *What video games have to teach us about learning and literacy*. Palgrave MacMillan.

Gee, J. (2012). The old and new in the new digital literacies. *The Educational Forum, 74*(4), 418-420. DOI: 10.1080/00131725.2012.708622

Gee, J. (2017). *Teaching, learning, literacy in our high-risk high-tech world: A framework for becoming human.* Teachers College Press.

Goode, K., & Vasinda, S. (2021). Videogames and Sensory Theory: Enchantment in the 21st Century. In L. Haas & J. Tussey (Eds.), *Disciplinary Literacy Connections to Popular Culture in K-12 Settings* (pp. 162-183). IGI Global. DOI: http://doi:10.4018/978-1-7998-4721-2.ch008

Haas, L. (2012). *A quantitative content analysis of leveled vocabulary embedded within massively multiplayer online role-playing games (MMORPGs)* (Publication No. 3511601) [Doctoral dissertation, Texas A& M University-Commerce]. ProQuest Dissertations Publishing.

Hamilton, L. G., Hayiou-Thomas, M. E., Hulme, C., & Snowling, M. J. (2016). The Home Literacy Environment as a Predictor of the Early Literacy Development of Children at Family-Risk of Dyslexia. *Scientific studies of reading: The official journal of the Society for the Scientific Study of Reading*, *20*(5), 401–419. DOI: https://doi.org/10.1080/10888438.2016.1213266 20

Kaltman, I. (2019). *Digital game-based learning enhances literacy.* New Jersey Education Association. https://www.njea.org/digital-game-based-learning-enhances-literacy/

Kervin, L. (2016). Powerful and playful literacy learning with digital technologies. *Australian Journal of Language and Literacy, 39* (1), 64-73.

Kovess-Masfety, V., Keyes, K., Hamilton, A., Hanson, G., Bitfoi, A., Golitz, D., Koç, C., Kuijpers, R., Lesinskiene, S., Mihova, Z., Otten, R., Fermanian, C., & Pez, O. (2016). Is time spent playing video games associated with mental health, cognitive and social skills in young children?. *Social psychiatry and psychiatric epidemiology*, *51*(3), 349–357. DOI: https://doi.org/10.1007/s00127-016-1179-6

Litowitz, B. (1993). Deconstruction in the Zone of Proximal Development. In Forman, E., Minick, N., and Stone, C. (Eds.) *Contexts for learning,* (pp. 184-196). Oxford University Press.

Livingstone, S. (2018). *The importance of video game literacy for healthy parenting.* The London School of Economics and Political Science. https://blogs.lse.ac.uk/parenting4digitalfuture/2018/09/05/the-importance-of-video-game-literacy/

Mitgutsch, K. (2011). Playful learning experiences: Meaningful learning patterns in player's biographies. *International Journal of Gaming and Computer-Mediated Simulations, 3*(3), 54-68. DOI: 10.4018/978-1-4666-4018-4.ch011

National Literacy Trust. (2020). *Video game playing and literacy: A survey of young people aged 11 to 16.* Retrieved October 26, 2020 from https://literacytrust.org.uk/research-services/research-reports/video-game-playing-and-literacy-survey-young-people-aged-11-16/

Neuman, S. B. & Celano, D. (2006). The knowledge game: Implications of leveling the playing field for low-income and middle-income children. *Reading Research Quarterly*, *41*(2), 176-201. DOI: https://doi.org/10.1598/RRQ.41.2.2

Neuman, S. B. & Celano, D. (2012). *Giving our children a fighting chance: Policy, literacy, and the development of informational capital*. Teachers College Press.

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Sage Publications, Inc.

Puglisi, M. L., Hulme, C., Hamilton, L., & Snowling, M. (2017). The Home Literacy Environment Is a Correlate, but Perhaps Not a Cause, of Variations in Children's Language and Literacy Development. *Scientific Studies of Reading, 21:6*, 498-514. DOI: 10.1080/10888438.2017.1346660

Rice M. (2014). Reviewing the Content of Videogame Lesson Plans Available to

Teachers. In: Gerber H.R., Abrams S.S. (eds) *Bridging Literacies with Videogames. Gaming Ecologies and Pedagogies Series*. SensePublishers, Rotterdam. https://doi.org/10.1007/978-94-6209-668-4_9

Rosin, H. (2013). The touch-screen generation. *The Atlantic*. https://www.theatlantic.com/magazine/archive/2013/04/the-touch-screen-generation/309250/

Salonius-Pasternak, D.& Gelfond, H. (2005). The Next Level of Research on Electronic Play: Potential Benefits and Contextual Influences for Children and Adolescents. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments, 1*, 5-22.

Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 22,* 360-407. DOI: https://doi.org/10.1177/0022057409189001-204

Souto-Manning, M. & Yoon, H. (2018). *Rethinking early literacy: Changing images of early childhood.* Routledge.

Wasik, B. (Ed.). (2012). *The handbook of family literacy*. Routledge.

Wellings, J. & Levine, M. H. (2010). *White Paper: The digital promise: Transforming learning with innovative uses of technology*. Joan Ganz Cooney Center Sesame Workshop. https://joanganzcooneycenter.org/publication/white-paper-the-digital-promise-transforming-learning-with-innovative-uses-of-technology/

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

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What Supports Do Teachers Need on Effective Instructional Technology Integration?

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Abstract

Studies focused on school information-communication technology (ICT) integration roles mostly concentrate on principals' perspectives on their roles for an efficient integration plan. As ICT availability increases, the need for a practical integration plan covering more roles and aspects of dynamic ICT integration increases. There are studies on principals' perspectives on their roles in technology integration, but there is little information on how teachers view their principals' roles. It is essential that teachers feel supported so they are motivated to integrate instructional technology effectively. This study explores teachers' views on the roles and responsibilities that principals undertake to influence instructional technology integration in Title I urban schools. The roles and responsibilities of campus leadership in this study were aligned with the International Society for Technology in Education (ISTE) standards for principals. The findings reveal that educators' planning evolves around preparing students for the future. Three themes emerged in ten teachers' interviews from a Title I urban Texas school on their views of principals' roles and responsibilities in technology integration: (a) availability of ICT resources, (b) principals' support for ICT integration, and (c) planning for effective instructional technology integration. This study illustrates how the ISTE Standards for Education Leaders support implementing efficient technology integration in schools and preparing students to promote digital-age learning.

Keywords: instructional technology, instructional technology integration, information-communication technology (ICT), principal support, technology integration planning, teacher training

The information and communication technologies (ICT) use in formal education is often assumed to have a positive impact on digital skills and 21st-century skills in general (Claro et al., 2012; Fraillon et al., 2014; Voogt et al., 2013 as cited in Schmid & Petko, 2019). Several studies point out that principals are responsible for ensuring effective instructional technology implementation in schools (Anderson & Dexter, 2000, 2005; Bellibas & Liu, 2016; Sergiovanni, 2009; Yanyan & Fei, 2019; Wieczorek & Manard, 2018). The National Center for Education Statistics (2010) supports this claim by reporting that the principal's role is crucial (Bellibas & Liu, 2016; Raman et al., 2019) for a practical application of instructional technology in schools. Furthermore, Sergiovanni (2009) claimed that ICT leadership is necessary (Bellibas & Liu, 2016) for all schools to increase the efforts on the use of instructional technology and goes on to argue that principals' involvement in the implementation of ICT use involves three primary goals: (a) leading/modeling ICT knowledge, (b) supporting/empowering teachers, and (c) planning for technology integration. Moreover, Cherian and Daniel (2008) pointed out the importance of principals to consider teacher voice in the development and implementation of instructional technology integration plans to make it efficient.

Principals are equipped for ICT leadership, and ICT leadership requires specific roles and responsibilities, including planning, promoting, supporting, and performing technology literacy growth (Bellibas & Liu, 2016; Hitt & Tucker, 2016; Wieczorek & Manard, 2018). Understanding what principals do in Title I urban schools about using ICT and exploring how teachers view these actions may provide insight into ICT leadership for principals new to Title I urban schools and existing principals to be conscious about their role as ICT leaders. It is essential to point out that we know a lot about what effective principals do, but we do not know how teachers are affected by principals' actions. Therefore, this research aimed to explore

teachers' views on school principals' roles and responsibilities in instructional technology integration in Title I urban Texas schools.

Moreover, while many factors come into play regarding technology integration, this research is focused on three specific areas, all of which derived from Collins' (2009) Technology Leadership, Management, and Policy Pyramid. This pyramid includes three sides that focus on organizational integration activities, planning activities, and maintenance activities. To keep the study focused on exploring teachers' views on school principals' roles and responsibilities in instructional technology integration in Title I urban Texas schools following research questions have been posed.

The main question of this initial exploratory study is, "How do teachers view the roles and responsibilities of school principals in the use of instructional technology in Title I urban schools? That is followed by sub-questions narrow the focus of the research on specific components of efficient technology integration.

1. What are instructional technology resources available to teachers?
2. What training and support are available to teachers?
3. What kind of support teachers receive from the principal?
4. What are teachers' views about leadership roles in effective instructional technology integration?
5. What barriers do teachers face for efficient technology integration?
6. What kind of support will help teachers to have a more efficient technology integration in place?

Purpose of the Study

The purpose of this initial small-scale study is to explore the teachers' views on the roles of principals in instructional technology integration. The setting is a Title I urban school in

Texas. The aim is to generate a basis for further studies of teachers' views of principals and principals' impact on effective ICT integration. As Somekh (2008) explained, teachers are not free agents. Teachers' teaching methods and values mostly depend on the cultural, social, and organizational settings they live and work (Buabeng-Andoh, 2012). As a result, learning methods are necessarily co-constructed and implemented with students, faculties, and local communities and restrained/enabled by education systems and cultures' regulative policies.

Literature Review

Today's students are comfortable with technology (Thomas, 2009); however, for educators and students to fully acquire and benefit from ICT, its educational use needs to be supported and modeled by teachers and school leaders. Sergiovanni (2009) stated that school principals are the most influential change agents (Adams & Muthiah, 2020; Bellibas & Liu, 2016). According to Cuban (2001), one of the everyday situations in many classrooms in Western countries is high access and low use. Although the recent survey results indicated that schools in most Western countries enjoy high access to ICT, the percentage of teachers reporting that they used it for teaching was comparatively low (Ertmer, 2005; Kozma, 2003; Law et al., 2008). Also, a comparison conducted between two international surveys in 1998 and 2006 by the International Association for the Evaluation of Educational Achievement revealed that computer and Internet access for pedagogical use has increased and that governments have formulated a national policy and have invested heavily in teacher training.

Accordingly, technology integration needs to be implemented in a meaningful, practical manner to realize its benefits. Educational leaders must work to reduce barriers to effective instructional technology integration. Hence, ISTE standards (2018) frame this study since those standards prescribe what principals need to produce a productive learning environment. The standards begin with the leadership and vision to motivate a shared vision for the complete integration of technology and promote an environment and culture to accomplish the vision. To

do this, principals assist in a shared vision with students, teachers, parents, and community members (ISTE, 2018). Since principals are the most critical factor of efficient ICT integration in schools' agents (Adams & Muthiah, 2020; Bellibas & Liu, 2016; Sergiovanni, 2009), principals may benefit from this research to understand teachers' perceptions of their roles in effectively integrate instructional technology in schools (National Center for Education Statistics, 2010).

Above all, Sergionvanni (2009) argues that teachers are more motivated to explore what instructional technology resources are available to them. ICT provides more access to professional growth and allows educators to converse with colleagues and experts in the field, parents, and others outside the school building's boundaries. ICT leadership is necessary for all schools as educational policymakers and administrators focus on increasing ICT use in the classroom.

However, according to Wetzel and Zambo (2004), many school districts fail to provide teachers and principals proper training. The National Education Association (2008) supported this claim by stating that educators are not sufficiently prepared to integrate instructional technology into classrooms and do not receive the technical support needed to impact student achievement. Therefore, without continuous technical support, ICT integration in the classroom is not satisfactorily achieved (Gahala, 2009). An international survey conducted in 2006 by the International Association for the Evaluation of Educational Achievement revealed that the perceived availability of technical, administrative, and infrastructural support was the most constant positive predictor of teachers' use of ICT. When administrators offer emotional and moral support by demonstrating interest in teachers' efforts to change the learning environment, there is a willingness to incorporate more ICT in the student learning process.

Technology Integration

Furthermore, according to Casner-Lotto and Barrington (2010), a survey of more than 400 U.S. employers revealed that high school graduates are entering today's workforce are

deficient in most of the 21st-century knowledge and skills needed to achieve successful careers. Those problems that occur can be eliminated when administrators include teachers in the technology integration planning and evaluation processes. Administrators, teachers, and school district officials must work together to collaboratively develop an ICT plan that increases technology's efficient use across the school.

Also, Kervin (2010) argued that professional development sessions should be developed with a long-term purpose. The most critical tool principals need is a plan that is ensuring support in all levels of ICT integration. Presently, everyone is pulling in a different direction, and there is no movement regarding instructional technology integration. So, Green (2009) suggested leadership must establish a direction, and followers must follow. A well-assessed need and skill-focused ongoing training planning are necessary (McKnight et al., 2016) for a successful ICT implementation.

Additionally, technology implementation and distribution efforts do not automatically ensure the best interests of the instruction. Technology implementation is often little more than promoting painless technology installation without really changing the activities, processes, and outcomes of the learning environment; that is, technology implementation accommodates the installation of technology but does not improve the classroom environment for student learning (Warschauer, 2010). The ISTE (2018) standards (while not empirically validated, they are in widespread use) were used to frame this study to explore teachers' views on principals' actions about technology integration to compare the standards with what is happening on the field according to teachers. Hardre and Sullivan (2008) concluded that Title I schools use technology for remediation purposes or enrichment in the classroom. Warschauer (2010) argued that this technology use leaves students behind in developing the necessary skills to succeed in future endeavors.

Through extensive research on principals' roles and responsibilities for technology integration for instructional use in classrooms, ISTE (2018) developed standards that are currently adopted by 46 states in the United States, including Texas. These are derived from five standards that demonstrate effective principals' integration of technology. ISTE standards clearly define the roles and responsibilities of all stakeholders for successful ICT integration. According to ISTE standards, principals identify, use, assess, and promote technology devices to enhance a standards-based curriculum and attain higher student achievement levels. Principals can benefit from the ISTE standards framework to facilitate and support collaborative technology-enhanced environments conducive to improved learning. Mostly, administrators develop, complement, and assess policies and guidelines to ensure compatibility with technological devices. Principals assess staff knowledge, skills, and performance in technological devices and plan professional development accordingly (ISTE, 2018).

Principals are decision-makers of the school, and the ones are planning instruction, budgeting, and supporting staff to improve their practices. Sergiovanni (2009) suggested that the most effective principals had a clear vision of how the school could educate its students, had aligned resources and priorities with the vision, and could engage all stakeholders within and outside the school to achieve the goals embedded in the vision. Moreover, the principals' clear vision will help teachers to be able to know what is expected from them and how they can get help to improve (Bellibas & Liu, 2016).

Similarly, Warschauer (2010) pointed out that principals' fundamental roles in their schools' success point to other leadership characteristics critical to a principals' success and teachers' instructional methods. Principals also make a difference in whether technology is used effectively for teaching and learning. Effective school principals provide leadership, resources, and ongoing professional development opportunities for teachers, setting the stage for technology use supporting instructional change and student learning. As a result, teachers'

views on leadership roles and responsibilities on technology integration explored due to the importance of principals' impact on effective ICT implementation.

Methodology

This research employed a descriptive research method to obtain information about teachers' views of the principal's technological leadership roles and responsibilities for integrating technology into the curriculum. Also, responsive interviewing was used for in-depth interviews.

Sampling

The sample for this initial, small-scale, exploratory study included ten teachers from an urban Title I school in Texas that promotes technology usage. This research's sampling method was purposive sampling; ten teachers were a group of teachers who work at the same school district as the researcher. The total teaching experience averages two to 21 years. Table 1 (below) summarizes information about teachers in this research.

Table 1: *Demographics of the teachers represented in the study.*

Student Group	Participants Name	Overall experience	Number of years in school	Formal technology education
Elementary	Ms. Amy	2 years	2 years	One basic computing course in bachelors' degree.
Elementary	Ms. Sims	10 years	8 years	None
Elementary	Mr. Davis	21 years	1 year	One basic computing course in bachelors' degree.
Middle	Ms. Crespo	4 years	2 years	None
Middle	Ms. Sally	8 years	7 years	One basic computing course in bachelors' degree.
Middle	Ms. Sirkel	17 years	3 years	One basic computing course in bachelors' degree.
Middle	Mr. Smith	5 years	2 years	One course of technology integration in master's degree.

Elementary	Ms. Silva	8 years	4 years	One basic computing course in bachelors' degree.
Elementary	Ms. Consuela	2 years	2 years	One basic computing course and intro to computer science in bachelors' degree.
Middle	Ms. West	11 years	5 years	None

Instrumentation

Semi-structured interviews were used due to their flexibility; the researcher was able to adapt the questions during the interview according to participants' responses to gather more detailed information. The interview questions for teachers were created after careful review of the literature and professors' input at the University of North Texas. The interview questions sought input about teachers' views on leadership roles on implementing instructional technology in the school and daily use of technology in the classroom.

The interview questions were created around the main research question:" What are teachers' views about leadership roles in effective instructional technology integration?"

Data Collection

Tracy (2013) suggested that researchers have responsibilities for building a reciprocal friendship for responsive interviewing, honoring interviewees with unfailingly respectful behavior. As a result of this suggestion, the researcher had talked to those teachers to build a relationship and helped them, as they needed, to build rapport with them even before mentioning the research. Moreover, Tracy (2013) stated that researchers should reflect on their own biases and openly acknowledge their potential effect and own the emotional impact of interviews. Creswell (2008) argued that the interview's dynamic nature allows participants to be more active than in a more structured survey. The opportunity to ask for more details during the interview allows the researcher to gather more information from primary answers and explanations. Also, the opportunity to observe, document, and interpret non-verbal interaction as part of a participant's feedback is invaluable during interviews. Participants were asked if they consent to audio

recording, so recording could be used to gather more details after the interview. The researcher spelled out her tendency to focus only on verbal clues if she relies solely on notes. Hence, the participants were encouraged to consent to the audio recording so that nonverbal clues, environment, and environment interactions during the interviews could be analyzed during the interview. The audio recording was optional for participants; all ten participants gave audio recording consent, and a transcribing software program (Otter) was used to record the audio during the interview process. Each interview lasted approximately 45-90 minutes.

This research relied only on in-depth interviews with teachers on technology integration for instruction. This study employed descriptive research by utilizing teacher interviews to gather information about teachers' perceptions of the principals' technological leadership roles and responsibilities for instructional technology integration.

The participants were informed of the interview protocol, and interviews were recorded and transcribed later. All information will be kept secure by the researcher to ensure the participants' confidentiality. Teachers who voluntarily agreed to participate were selected to be interviewed, and all participants are from the same campus to analyze and compare perceptions of the same leadership. The research and the purpose of the research were explained, and teachers were asked if they would participate in the study. The researcher sought official district approval and IRB approval before conducting interviews.

Sample Profile

Each participant was given a pseudonym to protect participants' confidentiality. Teachers' experiences as a teacher were two years to 21 years. One of the teachers took one technology integration course during his master's program, and six teachers took an introductory computing class during their bachelor's degree. The other three teachers do not have any formal training on technology other than the professional development programs they have attended. Teachers were motivated to seek informal training and self-taught instructional

technology. All teachers are working at the same school, and the same resources were available to them. Elementary teachers had five Chromebooks per teacher to use for stations and weekly one-hour computer lab schedules for all students' software time.

In contrast, middle school teachers had a cart assigned to them that shared among four more teachers. The school emphasizes STEM and technology, and the curriculum relies on supplemental software programs for intervention and enrichment of the students. Students have access to those instructional software programs at school and home.

These teachers are led by Principal Mr. Johnny (only pseudo-names used throughout), who is the school's ICT leader. He has started his educational career in this school system and has worked in different roles for about 12 years. He has been a principal for the same campus for the last three years.

This study is based on insights of the teachers gathered during the semi-structured interviews. Gall et al. (2007) claimed that interviews are used frequently in educational studies to gather data about phenomena that are directly observable, such as personal experience, opinions, preferences, and interests, as well as relationships among these phenomena. The data given by the teachers' interviews were analyzed to authenticate results.

Interviews were recorded and transcribed via the Otter transcribing software app. The interviews were recorded to collect data and transcribed to present an impartial view of the data. During the interviews, the researcher took notes and the audio recording of the interview in case the recording has any issues. The teachers were interviewed individually via Zoom, a video conferencing tool. Initially, the research was planned to have face-to-face interviews, but the COVID19 pandemic started, and schools closed. These changes led to a format change in the study from face-to-face to virtual interviews. Teachers were asked to use pseudonyms to join virtual interviews to protect their identities.

Data Analysis

Data from the interview questionnaire were analyzed to look for themes. Then, responses collected from interviews and data were analyzed to formulate conclusions. As Gall et al. (2007) suggested, themes and patterns were used to form categorical data. This study's outcomes were displayed in the descriptive narrative form to ensure the research's clarification and recognition. NVivo program was used to code and examine data for this research.

Coding allowed to review, contrast, and classify the data. The raw data were examined for relationships and differences, and primary conceptual categories were developed from interview responses. This approach allowed the researcher to formulate conclusions from the data analysis regarding teachers' perceptions of school principals' roles and responsibilities for instructional technology integration in Title I urban Texas schools.

Findings

Findings are provided here under subtitles that are created according to themes in teachers' views. Each subtitle discusses the results in detail and teachers' beliefs.

Teachers Analysis of the Roles and Responsibilities of Principals

Three main themes developed from teachers' interviews regarding the teachers' views on principals' roles and responsibilities in instructional technology integration: (a) availability of instructional technology resources, (b) principals' support for technology integration, and (c) planning for efficient instructional technology integration. All those themes were correlated to the ISTE standards for education leaders (principals). As an exploratory study, these three themes merit further scrutiny in future studies.

Table 2: *Comparisons of Research Questions, Themes, ISTE Standards, and Analysis of Teachers' Input.*

Research Question	Theme	ISTE standard	Teachers input theme	Teachers' quotes
Q.1, Q.5,	Availability of instructional	Principals (educational leaders); Ensure	-Outdated equipment	" Teachers will not be invested in training that they

	technology resources	all students have access to the technology and connectivity necessary to participate in authentic and engaging learning opportunities. (ISTE, 2018).	-Delay in the device distribution	know very well; they cannot even put into practice." "School does not have updated laptops for teachers." "I think it is the availability of devices itself is our major problem." "There are so many teachers that were without computers for quite a long time."
Q.4, Q.7, Q.8, Q.9, Q. 10, Q.11, Q.12	Principals' support for technology integration	Principals ensure that resources for supporting the effective use of technology for learning are sufficient and scalable to meet future demand. (ISTE, 2018)	-Service limitations in technology maintenance -Resistance to change -Lack of principal support	"The admin has been there for a while, and it is kind of like, well, this is our norm now, and it is apparently not going to change. So, why address it." "So, if devices are broken or in need of repair that they are not being repaired or replaced on time." "I really do not see much administrator support." "We need to make sure that somebody on campus is dedicated to helping resolve technology issues." "Nobody will do anything if they know there is not going to be the support there."
Q.6, Q.9, Q.10, Q.12	Planning for efficient instructional technology integration.	Principals ensure the integration of technology to support effective systems for learning, professional development, and organization (ISTE, 2018)	-Lack of proper need-based training -Teachers not being familiar with the resources -Delay in the device distribution	"If I were the principal, I would make sure my teachers are trained in the technologies they use." "I was not really trained." "We did not get student Chromebooks until one or two months in the school year." "I did not get the proper training, so I rarely use it in my classroom."

Teachers stated they believe the main barriers to efficient instructional technology integration were: (1) lack of proper need-based training, (2) outdated devices, (3) lack of support staff on campus to help and support teachers with technology integration, (4) delay in the device

distribution, and (5) service limitations in technology maintenance. Some issues emerged from responses that are barriers for those resources to be used: proper training for the resource, frequent changes in ICT being used, and teachers lacking familiarity with the resources.

Instructional Technology Resources Available to Teachers

The main research question and sub-questions guided the study by gathering essential supporting data from teachers on their views on school principals' roles and responsibilities on implementing instructional technology in Title I urban Texas schools. To the first sub-question on what instructional technology resources are available to teachers and what training and support teachers have, Ms. West responded: "The biggest barrier to me was the age of my laptop computer. They are not getting fixed at all. Some of our Chromebooks (student devices) had missing keys. So, there is no regular maintenance going on for student devices. I do not think the person who oversees all the computers and technology instructor has the staff to keep up with that demand." Teachers' responses demonstrated instructional technology materials available to teachers as part of the school's vision of technology and STEM. However, using these resources is not efficient due to the lack of data collection on how these resources are being used and the issues teachers are facing.

All participant teachers stated that they have many technology resources in class, such as laptops, document cameras, projectors, chrome book student devices, and many supplemental software programs. Teachers stated that those resources are essential to keep up with the changes of the century. Ms. Amy reported: "Teachers are not going to be effective in the use of technology without the support from admin, without the support of the actual training, and without the support of having working technology. Furthermore, I know that our campus has many teachers who do not feel that support. So, then it feels like it is a lack of importance. Also, I have heard of this incredible technology, but I do not have Chromebooks in my classroom. So how am I supposed to do technology or, you know, I am trying to get my computer to work, but it

is not working at all. So how am I supposed even to put this up to do this with it? Teachers are not going to be effective in the use of technology without the support of the principal, without the support of the actual training, without the support of having the technology that's working or the technology that's in the classroom."

The only concern regarding resources was that the campus keeps changing the resources they use, and sometimes it happens without training teachers. Ms. Sims stated, "every year we get a new program. So, every year we had to learn something new, so programs are changing too often. It is like even if you are training yourself, how to navigate the program or the software. Then, a year or two later, you are getting a new one. There are so many different reading programs that we have started and then, and then the next year it is a new one. We have all these software programs available to us, but we do not always know how to implement them. The idea of them sounds great, but then when you are actually in front of the computer in the computer lab, we do not always know [exactly] what to do." Ms. Amy stated, "honestly, as a teacher, you have so much that is going on, then that falls to the back burner if you do not know exactly what they want out of it. Like what can it do? And where is that even located."

Most of the teachers noted that if a teacher wants a whole class to work on an activity using chrome books, they were available. The cart of Chromebooks could be signed out, and the computer lab could accommodate almost a class of students when signed up for by the teacher at the beginning of the year. Overall, teachers believed that their school is technologically equipped to keep up with technology development changes that bring out everyday life and other schools. However, they have issues with devices because they become outdated, and it takes time to update them during the year. Ms. Sims noted:" if devices are broken or in need of repair, they are not being repaired or replaced on time. If the teacher requests IT help, the request is not being answered on time. There are so many teachers that were without computers for quite a long time that, you know, how can we implement technology

in the classroom and not even the teacher has not one available to her or his disposal. So, I think, just [it is] accountability. Overall, making sure we hold our students accountable or teachers accountable, and that must come from the top, because if we allow people to get away with things, unfortunately, they do, you know, not everyone has that integrity."

Proper Need-Based Training Opportunities for Administrators and Teachers

According to teachers', lack of adequate training seems to be the most common theme among these teachers' views for technology usage. Each teacher receives training as the campus decides to start using a new program. However, these trainings are mostly occurring with a big group of teachers and are not differentiated by the teacher's needs and goals. Teachers did not find it efficient since teachers are at different levels of technology usage literacy. Ms. West reported:" you did not just get kind of tossed into it, and we are expected to know these things already. We do have training at the beginning of every year to make sure that we understand how to integrate because there are specific grading programs that we must know. She also added that "I need school principal to understand that every teacher has their own specific needs, and everyone is different so their needs."

Some teachers said even they had received the training, they either self-taught the program or ask their colleagues whom they know are good with technology to help them. Another teacher, Ms. Amy, stated that some of those training is just to learn the basics, basically, then you know once you learn it, then maybe having another training showing some of the more in-depth things that it can do or that you can use it for, but also just making it clear for the expectations of why we are doing it would help her to use these resources more efficiently. Ms. Sims stated that she did not use most of the available resources since she did not know how to use them. She also stated that she had a SMARTboard available to her, but she did not know how to use it. She stated that she tried her best but never officially got any training on how to use it. Moreover, often she was the one person who had to set it up as well."

Principals' Support in Technology Integration for Teachers

Teachers stated they were surprised to be asked what support they receive from their principal. All teachers thought that if they needed help with any technology, they either asked their grade level team or IT person to help them out. Teachers stated that technology integration is something that has been brought up during teacher evaluations. Ms. Amy reported:" I would say that is something that's on our evaluation but then, during a regular day, like I said I have five Chromebooks in my classroom, so it is not much of support, in the sense of it being there, so I do not know the budget for the school. If it is essential, then I think that it should become part of the budget." Ms. Sirkel reported the support she receives from campus leadership depends on the administrator she asks for help. She noted:" it depends on the administrator. I think some administrators are very quick to not listen to your problem and just say go to the IT person. However, there are other administrators that are well let me see if I can help you. And then not just referred to the IT person, you know, and I think that could also be because maybe different administrators are more comfortable with the technology than others."

Ms. Sims noted:" I mean, technology is there, but they are not supporting us on being trained for it or implementing it. Moreover, they are not really supporting us and making, sure enough, technology is available. I really want to be put the technology into the students' hands. However, it is just not available, so I will just have a conversation about that. And then, you know, as always. "Hopefully, we can do something about that maybe next year we will get more," quoted principal, but, you know, eight years into it, I still have not seen technology being integrated the way I would like it to be into my classrooms." All teachers stated they feel bad about asking for IT help since everybody relies on him, including administrators. Hence, they avoid asking for help and choose not to use the technology.

Planning Technology Usage in the classroom

Teachers stated that if they do not ask for specific issues to be fixed with their devices or let someone know they need help with technology integration, nobody would know there are issues with technology integration until teacher evaluation. Some teachers brought up; they have had problems for a long time, which causes them not to use technology in class for one month to two months. All teachers stated they received the student devices two months after school started, and by then, they already had a system in place, so they did not use the devices as much as they would if they had them at the beginning of the school. Ms. Sims stated: "I do not even know who our IT guy is; I was never introduced to him; I just heard a name and was told to make an IT request with any issues. So, I think it is important that all teachers have some sort of relationship with that person, just like be at least being introduced to this person so that you feel comfortable enough to reach out to him or her and to know that they can help solve your issues or they want to."

Ms. Sims stated if she were the principal: "I would train my teachers about technology, and then I would follow up with it, like, here is our IT person so he or she also knows about this technology or the software and has been trained so if you have questions throughout the year go to him or her, they will be able to help you. Because often, if I do not think this person would even know anything about this software or this program that I want to implement." She also added that:" I think it also not just giving a training but also following through like following up with teachers. Thus, when you go in for those observations, you know, the teachers have had up the technology training, or the training on the software, you should be able to walk into the classroom at any time and see it being implicated, and not just forget about it, because often I feel like we have had excellent training. However, then we are not kind of held accountable for how we are implementing in the classroom."

Summary of Findings

The teacher's view of principals' roles and responsibilities presented three themes about principals' roles and responsibilities: (a) ensuring availability of ICT resources for instruction, (b) support teacher on ICT integration, and (c) planning for efficient ICT use in the classroom. Teachers' views on the principal's roles and responsibilities for the ICT depended on the technology available to support learning and planning with the principals on what is needed to ensure efficient ICT integration. The maintenance of technology devices was a significant barrier encountered by all teachers. Technology maintenance personnel workload was an issue that caused delays in the maintenance of devices in the school that participated in this study. As a result, if technology devices do not work, teachers cannot use them in class. Technology devices that do not work often cause changed classroom instruction that may not be as efficient for the students. Hence, teachers believed it is the principals' responsibility to ensure all technology works before school starts.

Teachers stated that they experienced issues when technology was provided to them without any support from the principal or a need-based focused training, which the principal should have planned before technology was provided or school started. Trying to learn to use the technology while trying to teach was overwhelming and resulted in decreased use of technology and decreased teacher motivation. For instance, SMART boards were installed in classes in the middle of the year without any support or training, which resulted in them being used as an overhead projector. Buabeng-Andoh (2012) points out the importance of teachers' professional development as a critical factor (McKnight et al., 2016) in successfully integrating computers into classroom teaching.

Moreover, according to teachers, some ICT devices are out of date; the principal did not ensure all devices are up to date and running before the school's first day. Teachers agreed that planning for technology was imperative, and it is the principal's responsibility. All teachers had

similar concerns, such as the availability of technology resources, lack of principal support, and lack of planning at various levels.

To summarize, the main findings are that teachers perceived that the main barriers to instructional technology integration were: (1) lack of proper need-based training, (2) outdated devices, (3) lack of support staff on campus to help and support teachers with instructional technology integration, (4) delay in the device distribution, and (5) limited-service in technology devices maintenance. Teachers in the study believed that technology integration is not a priority for their principals.

Summary of Conclusions

The main question of this study was, "How do teachers view the roles and responsibilities of school principals in the use of instructional technology in Title I urban schools? One of the ISTE's (2009) standards related to this question was the vision of instructional technology integration that principals demonstrate in planning. Teachers who participated in this study stated they believe that planning was imperative for efficient technology integration (Wieczorek & Manard, 2018). Cherian & Daniel (2008) pointed out that the increase in technology usage in schools increased principals' need (Bellibas & Liu, 2016; Wieczorek & Manard, 2018) to ensure an efficient instructional technology implementation and planning for their schools to keep up with 21st-century learning environments. All participants believed that planning was a significant or maybe most important step in integrating technology. They brought up that lack of planning was one of the obstacles they have for efficient technology integration.

Another ISTE standard analyzed involved curriculum design, instructional approaches, and learning environments to integrate the relevant technologies for the best learning and teaching environment possible (ISTE, 2018). As ICT leaders, principals are responsible for preparing and supporting teachers for instructional technology integration (Bellibas & Liu, 2016;

Wieczorek & Manard, 2018). Also, principals are responsible for assuring that technology devices are ready to be used before school starts and provide ongoing support throughout the year by hiring IT staff. All the teachers in this study stated they used instructional technology to enhance student learning daily. They needed their principal to support them (Wieczorek & Manard, 2018), and they believed that they could not integrate instructional technology efficiently without this type of support.

Kervin's (2010) suggestion that professional development sessions should be developed with a long-term goal reminded us of the importance of efficient and well-planned training (McKnight et al., 2016) sessions for all teachers. Teachers believed that it is the principal's responsibility to plan professional development sessions according to teachers' needs and efficacy with ICT. According to the teachers, the principal made sure teachers were trained for instructional software, but training was held in big groups with different teachers' ability groups. ICT provided students data for teachers to intervene, reteach, or enhance the lesson. Teachers stated the immediate feedback and ability to get assessment results are one reason they use technology in instruction. Teachers reported that they had not received any training on technology devices, and nobody would check on them to see if they need help with any ICT they have in their class.

The findings demonstrated that those teachers do not perceive that their principals see their instructional role even though that is essential for reliable instructional program implementations. The data analysis shows that participants believed that extensive planning has a critical role in efficient instructional technology integration. Analysis of the data classified themes from participants that overlay, reinforcing school principals' importance on efficient instructional technology integration. As pointed earlier, planning for technology integration was the central area identified as increasing technology integration efficiency. All participants

believed that the school principal is the primary person responsible for preparing all stakeholders for efficient technology integration (Wieczorek & Manard, 2018).

Teachers reported that they had professional training to learn the use of technological software in everyday instruction. They attended professional training and felt that the training groups were big, and it felt it is getting done just because the district requires it. A future research can focus on principals' purposes when planning for professional development for their teacher to gather data and compare that data with teachers' perceptions.

Principals indeed are the most crucial element for effective instructional technology integration (Raman et al., 2019; Yanyan & Fei, 2019). The principal's vision affects the whole school environment. Therefore, this study can assist educators, policymakers, and administrators by highlighting principals' roles and responsibilities for efficient instructional technology integration and pointing out teachers' perceptions of the importance of principals' roles. This can increase awareness of principals' views on the importance of their roles and responsibilities on ICT.

As we are experiencing the COVID-19 pandemic, most of us saw the pandemic as an opportunity to finally integrate technology in education; however, teachers and parents experienced unplanned technology integration that might decrease educational technology usage motivation for educators. On the other end, teachers might feel more courageous to keep using some resources they have had a good experience with. Administrator support is essential now and after we are back to regular face to face instruction to help teachers and families get back on their feet. Schools do not need to focus on developing new plans for any new technology integration. All stakeholders need to sit back and feel the Pandemic is over and ready to be back to normal. Teacher support will need to be a priority for schools to support teachers and students in overcoming the stress and difficulties caused by the challenges they faced during the Pandemic.

This study was brought up with the hope of shedding light on teachers' perceptions of the importance of leadership practices for technology instruction (Yanyan & Fei, 2019; Wieczorek & Manard, 2018). Britten et al. (2009) pointed out that principals must be aware of the importance of their role in promoting definite changes for students who will perform in the 21st-century society of growing technological inventions. Therefore, teachers' views on school principals' roles and responsibilities were investigated to provide insight into schools' technology leadership. Being aware of the importance of principals' instructional technology role and taking responsibility for it can help solve the issue pointed by Cuban (2001) that western countries are not using technology efficiently than the technology available to them. This research supports the importance of efficient implementation of the instructional technology leadership role and the impact of following ISTE standards. Further studies can focus on how implementing ISTE standards can improve ICT usage in schools.

Limitations and Future Research

To focus on the teachers' views on principals' roles and responsibilities for instructional technology integration in Title I Texas urban schools, interviews were conducted with Title I urban teachers who volunteered to participate. Research data was gathered from ten teachers only; campus leadership's perception was not included. Also, this study solely relied on in-depth interviews with teachers on technology implementation for instruction. The primary limitation is the small sample size and use of only one school. As previously stated, the goal was to identify factors to be explored in more depth in future studies.

Future research should gather data from teachers, principals of several schools and district administrators, and perhaps from students and parents to compare perceptions to see gaps and similarities of perceptions to explore how a more efficient technology integration plan that considers all stakeholders and compares these data to ISTE standards for each stakeholder. Active leadership for principals in integrating ICT should be a priority for students'

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education and prepare them for skills they will need in the future. Therefore, principals' necessity to expand their awareness and understand how to integrate ICT efficiently should employ ensuring the most effective use of ICT to support all learning environments.

References

Adams, D., & Muthiah, V. (2020). School principals and 21st century leadership challenges: A systematic review. *Journal of Nusantara Studies, 5*(1), 189-210. http://dx.doi.org/10.24200/jonus.vol5iss1pp189-210

Anderson, R. E., & Dexter, S. L. (2000). School Technology Leadership: Incidence and Impact (Teaching, Learning, and Computing: 1998 National Survey, Rep. No.6). UC Irvine, Center for Research on Information Technology and Organizations. Retrieved from https://files.eric.ed.gov/fulltext/ED449786.pdf.

Anderson, R., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*(1), 49–82.

Bellibas, M. S., & Liu, Y. (2018). The effects of principals' perceived instructional and distributed leadership practices on their perceptions of school climate. *International journal of leadership in education*, *21*(2), 226-244.

Britten, J., Clausen, J., & Lecklider, D. (2009). Principals' priority for technology as an indicator of observed use in classrooms*. AASA Journal of Scholarship and Practice, 5*(4), 27-33.

Buabeng-Andoh, C. (2012). Factors influencing teachersâ adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using ICT*, *8*(1).

Casner-Lotto, J., & Barrington, L. (2010). *Are they really ready for work?* The Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management. Retrieved from the 21st Century Skills website: http://www.21stcenturyskills.org/ documents/ FINAL_REPORT_PDF9-29-06.pdf.

Cherian, F., & Daniel, Y. (2008). Principal leadership in new teacher induction: Becoming agents of change. *International Journal of Education Policy and Leadership, 3*(2), 1-11.

Collins, John W. (2009). *Technology Leadership, Management, and Policy: A Primer and Integrative Model for the 21st century*. Ithaca Press: Ithaca.

Creswell, J. W. (2008). Research design: Qualitative, quantitative, and mixed methods approach. Thousand Oaks, CA: Sage.

Cuban, L. (2001). *Oversold & underused: Computers in the classroom.* Cambridge, MA: Harvard University Press.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational technology research and development*, *53*(4), 25-39.

Gahala, J. (2009). *Critical issues: Promoting technology use in schools*. Naperville, ILL: North Central Regional Educational Laboratory.

Gall, M., Gall, J., & Borg, W. (2007). *Educational research: An introduction* (8th ed.). Boston: Pearson Education.

Green, R. J. (2009). *The four dimensions of principal leadership: A framework for leading 21st-century schools.* Boston: M. A. Allyn & Bacon Publishing.

Hardre, P., & Sullivan, D. (2008). Students' differences and environment perceptions: How they contribute to student motivation in rural schools. *Journal of Instructional Media, 31*(1), 45-49.

Hitt, D. H., & Tucker, P. D. (2016). Systematic review of key leader practices found to influence student achievement: A unified framework. *Review of Educational Research, 86,* 531-569. http://dx.doi.org/10.3102/0034654315614911

ISTE. (2018). *Iste standards for education leaders*. https://www.iste.org/standards/for-education-leaders.

Kervin, L. (2010). Incorporating technology within classroom literacy experiences. Journal of Literacy and Technology, 11(3), 77-101.

Kozma, R. B. (Ed.). (2003). *Technology, innovation, and educational change: A global perspective.* Eugene, OR: International Society for Technology in Education.

Law, N., Pelgrum, W. J., & Plomp, T. (2008). *Pedagogy and ICT use in schools around the world. Findings from the IEA SITES 2006 study*. CERC studies in comparative education. Hong Kong: Comparative Education Research Centre, The University of Hong Kong, and Dordrecht: Springer.

McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of research on technology in education*, *48*(3), 194-211.

National Center for Education Statistics. (2010). *Rural education in America*. U. S. Department of Education, Institute of Educational Sciences. Retrieved from http://nces.ed.gov/surveys/ruraled/page2.asp

National Education Association. (2008). University design for learning: Making education accessible to engaging for all students. *NEA Policy Brief*. Retrieved from www.nea.org.

Raman, A., Thannimalai, R., & Ismail, S. N. (2019). Principals' Technology Leadership and Its Effect on Teachers' Technology Integration in 21st Century Classrooms. *International Journal of Instruction*, *12*(4), 423-442. https://doi.org/10.29333/iji.2019.12428a

Schmid, R., & Petko, D. (2019). Does the use of educational technology in personalized learning environments correlate with self-reported digital skills and beliefs of secondary-school students? *Computers and Education*, *136*(March), 75–86. https://doi.org/10.1016/j.compedu.2019.03.006

Sergiovanni, T. J. (2009). *Rethinking leadership: A collection of articles*. Thousand Oaks, CA: Corwin Press.

Somekh, B. (2008). Factors affecting teachers' pedagogical adoption of ICT. In J. Voogt et G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 449–460). New York, NY: Springer.

Sun, Y., & Gao, F. (2019). Exploring the roles of school leaders and teachers in a school-wide adoption of flipped classroom: School dynamics and institutional cultures. *British Journal of Educational Technology*, *50*(3), 1241–1259. https://doi.org/10.1111/bjet.12769

Thomas, D. (2009). *Leading for equity: The pursuit of excellence in Montgomery county public schools.* Cambridge, MA: Harvard Education Press.

Tracy, S. J. (2013). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. Hoboken, NJ: Wiley-Blackwell.

TSSA Collaborative. (2009). *Technology standards for school administrators*. Retrieved from http://cnets.iste.org/tssa/pdf/tssa.

Warschauer, M. (2010). New reports on technology in U.S. schools: The changing divide. *Papyrus News: On Digital Learning and Literacy.* Retrieved from http://papyrusnews.com/about-papyrus/

Wetzel, K., & Zambo, R. (2010). Contrast in classroom technology use between beginning and experienced teachers. *International Journal of Technology in Teaching and Learning, 3* (1), 15-37.

Wieczorek, D., & Manard, C. (2018). Instructional Leadership Challenges and Practices of Novice Principals in Rural Schools. *Journal of Research in Rural Education*, *34*(2), 1-21.

Appendix 1. Interview Questions

What are teachers' views about leadership roles in effective instructional technology integration?"

The sub-questions listed below guided the study:

1. Describe any formal technology education you have had.

2. How many **y**ears of experience do you have as a teacher?

3. What technologies are available to you, and what technologies do you use during instruction?

4. What are your goals you plan to reach by using the technology in class? What is your motivation for using ICT instead of lecturing?

5. Who do you have as a support for technology use in your classroom?

6. How do you integrate technology into instruction?

7. What do you see as barriers to your technology integration?

8. How do you get support from your administrator on technology integration?

9. If you were the campus principal, what would you do to support teachers with technology integration?

10. What could be done differently to support you in integrating technology more efficiently?

11. Tell me more about how the campus administrator can help and support you with technology integration?

12. What kind of support will help you to have a more efficient technology integration in place?

13. What did you feel was the most important thing we talked about today, and why?

14. Is there anything you would like to add, or is there anything you feel I should have asked, and I did not ask?

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The Digital Poetry Machine Supporting Lower Secondary Students' Poetry Writing

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Abstract

In this study we investigate whether a digital tool supports lower secondary school students in poetry writing and influences on students' perceptions of poetry. It is essential to find new means to develop students' weakening writing competencies with digital tools and methods. This study analyzed students' perceptions of poems before and after writing poems with a co-creative tool called the Poetry Machine and the log data of poems written with it. We found that draft poems offered by the tool supported the students. Interestingly, this support received a higher evaluation by male students compared with the assessment by female students. The participants' perceptions of poetry writing changed positively during the period when using the tool and most of them considered writing with it to be easy and fun. Our findings suggest that digital tools have the potential to change positively perceptions about challenging literary forms, such as poetry, and especially to support male students in writing. Digital tools, such as the Poetry Machine, offer opportunities to motivate students in online learning. However, the young students need support both in face-to-face and online learning environments.

Keywords: digital literacy, digital tool, Poetry Machine, poetry writing, lower secondary education

The increasing use of digital technology in school and online learning and teaching have heightened the interest in studying students' writing practices with digital tools. In this study, the focus is on students' poetry writing with digital tools. Students can experience poetry writing through the characteristics and affordances of digital tools easier than through traditional means. It is important that students write their own poems in addition to just reading them, which is now a common situation at school (Certo et al., 2012; Xerri, 2013). By writing poems, the students learn to understand poetry and its structures and features better. Poetry writing gives students an opportunity to express themselves and makes them into producers of poems. Especially in technological environments, in which students write with the support of digital tools, their role as content producers is emphasized and they are no longer only consumers (Niemi & Multisilta, 2016).

Despite poetry's significant role as one of the main genres in literature and the emphasis on poetry as a genre in the curriculum of secondary education in many countries (Fleming, 1992; Sigvardsson, 2017, 2019), poetry is feared and unpopular in schools (Fleming, 1992; Hawkins & Certo, 2014), and students consider poetry writing to be difficult (Wilson, 2007). It is also commonly known that poetry writing improves creative thinking and linguistic skills, which are necessary in all kinds of writing (Edward-Groves, 2012; Myhill & Wilson, 2013).

Learning to write poems is different from other types of writing in school because poetic language has structural features including the line and stanza structure as well as rhythm or meter (Wilson, 2007). Poetry writing is a challenging creative process that demands cognitive and intellectual work while also being linguistic and imaginative play (Wolf, 2006; Certo, 2015). To support the learning of poetic structures and features, Certo (2015) and Wilson (2007) emphasized practices in which students are offered published poems as models and mentor texts. New and innovative digital writing tools together with mentor and model texts mediate students to enhance their writing competencies (Ching, 2018; Dredger & Martin, 2017; Howell,

2018; Kang, 2018; Nobles & Paganucci, 2015), not only in poetry writing but in all writing genres.

Students' attitudes influence writing: do they favor approaching or avoiding the task and what is their motivational state (Hamilton et al., 2013). Motivation contributes to the quality of written texts (Troia et al., 2013). Emotional aspects, such as considering writing tasks as fun, combined with commitment to work, supports the writing process (Niemi & Multisilta, 2016). Finding enjoyment in reading and writing and spending time on them affects both intrinsic motivation and creative thinking, which further also affect self-estimated ability to manage writing tasks (Hamilton et al., 2013; Wang, 2012).

Interest and abilities in writing differ between female and male students. Male students' writing attitudes are more negative, and they dislike writing in school, and because of their poorer literacy competency they are less successful than female students (Merisuo-Storm, 2006). Female students' writing abilities are also better than male students' (Troia et al., 2013). According to the PISA 2018 results, the gender gap in literacy in favor of female students has also been one of the highest in Finland (Programme for International Student Assessment [PISA], 2019). Regarding writing poetry, both female and male students concern it the least attractive genre of writing, though female students enjoy it more than male participants (Merisuo-Storm, 2006). To support poetry writing it has been suggested that the use of computers and model texts can motivate and support male students to write (Hawkins & Certo, 2014; Merisuo-Storm, 2006). On the contrary, Hanratty (2011) argues that they are at least as capable of responding to the demands of poetry as female students.

Broadening Definition of Literacy

Digitalization is changing the nature and importance of literacy. It has changed the writing process, which now requires at least technical skills and creativity (Edwards-Groves, 2012; EU, 2012a). The concept of literacy is changing to digital literacy, and it can refer to

information and communication technology (ICT) skills (Hall et al., 2014) or emphasize media literacy (Buckingham, 2015; Erstad, 2015). It can also mean the capacity to understand and create multimodal texts (Baird & Henninger, 2011; Merchant, 2007). Moreover, it can cover a combination of technical, cognitive and emotional-social skills and practices (Aviram & Eshet-Alkalai,2006; Lankshear & Knobel, 2015). The definition of digital literacies changes as technology develops, with new technologies often requiring new skills (Coldwell-Neilson, 2017). In this study, we define digital literacy similarly to Hague and Williamson (2009), as a combination of reading and writing of digital texts, social awareness, critical thinking, and competencies in using digital tools. In school, this means the students' ability to use digital tools to enhance their skills, knowledge, and understanding as learners and citizens.

Students perceive their writing to be superior with the support of digital tools (Nobles & Paganucci, 2015). Even though digital tools motivate students to write (Ching, 2018; EU, 2012b; Howell, 2018; Kang, 2018; Nobles & Paganucci, 2015), there is a gap between print-based literacy practices in school and digital reading and writing at home (Erstad, 2015; EU, 2012a; Merchant, 2007). To narrow the gap, students' home experiences on entertainment devices need to be linked with their academic lives. Although writing has been identified as a key competence and despite many students having difficulties with it, writing has received much less attention than reading at the international policy level (Blikstad-Balas et al., 2018; EU, 2012b; OECD, 2009). The change from traditional literacy to digital literacy causes pressure on schools (Blikstad-Balas et al., 2018; Edwards-Groves, 2012; EU, 2012b) and it is essential to find new means to develop students' competencies in writing with digital tools and new methods.

Writing poems at secondary school, and with the support of digital tools, is an understudied topic. The research considering students' poetry writing has tended to focus on the poetic language features of elementary school students' poems and children's intertextual

poetry writing practices (Certo, 2015; Kamberelis, 1999; Wilson, 2007; Wolf, 2006). A recent study by Dreger and Martin (2017) investigated how graduate preservice teachers mentored 9th -grade students' poetry writing in an online course. Most studies have emphasized reading, interpreting and performing poems (Fleming, 1992; Kelly, 2005; Smith, 2010), or teachers' perceptions of teaching poetry (Myhill & Wilson, 2013; Xerri, 2013), as opposed to students' perceptions of poetry and practices of poetry writing, especially with digital tools. This study seeks to fill these gaps in investigating the use by lower secondary students of a digital tool to support poetry writing in school and perceptions of it.

The Aim and the Research Questions

The aim in this study was to investigate whether lower secondary students' experience of a digital co-creative tool called the Poetry Machine supported them in the challenging task of writing poems. We also considered whether there are differences regarding the self-estimated support of the digital tool between different student groups according to perceptions of literacy, grades, and gender. Previous research has established that poetic language can be taught by offering models of poems and that writing with computers can especially motivate male students (Hawkins & Certo, 2014; Merisuo-Storm, 2006). In our study, the digital tool, based on applying artificial intelligence in the language structures, offers those models by generating a draft poem for a student and then offering various specific tools to develop it by using a computer, so that a poem is eventually created through human-computer co-creation (Kantosalo et al., 2014). We consider first the research question (1) How do students use the digital Poetry Machine? The second question is a two-fold question (2) How does writing with the support of the Poetry Machine influence students' perceptions of poetry writing, and how do these perceptions differ according to students' perceptions of literacy, grades, and gender?

Methods

Context and Participants

The study was conducted in a lower secondary school in Finland. The Finnish National Core Curriculum emphasizes 'multiliteracy', the ability to produce and interpret diverse texts since 2014 (FNAE, 2014). This has increased the need to use digital tools for writing.

Sixty-one students in two 7th grade basic education groups (mean age 13.2 years) participated in the study (29 males, 32 females) in Finland. All but two of them (99.8%, *n* = 59) spoke Finnish as their first language and 1.2% (*n* = 2) of participants spoke a second language at home (Estonian and English). The students are from the same local area of middle-class families because in Finland, students usually go to the neighborhood school. The students had used digital technologies during earlier studies of the Finnish language and literature and their teachers assessed their competence in digital technology as good. The students' grades in the Finnish language and literature subject according to the school report were the following: excellent 3% (2), very good 51% (31), good 28% (17), satisfactory 16% (10), and moderate 2% (1).[1] Female participants' average grade in the subject was statistically significantly higher compared with the male participants' average grade (female mean 8.7, male mean 7.9, p=.003) The two participating teachers worked in the same school. They were female, aged 28 and 51 years old, respectively; their teaching experience was (1) three years and (2) 26 years. They showed interest in integrating digital technology in their teaching, and they were committed to the teaching and research process using the Poetry Machine. The teachers were recommended for the study by a local active ICT teacher.

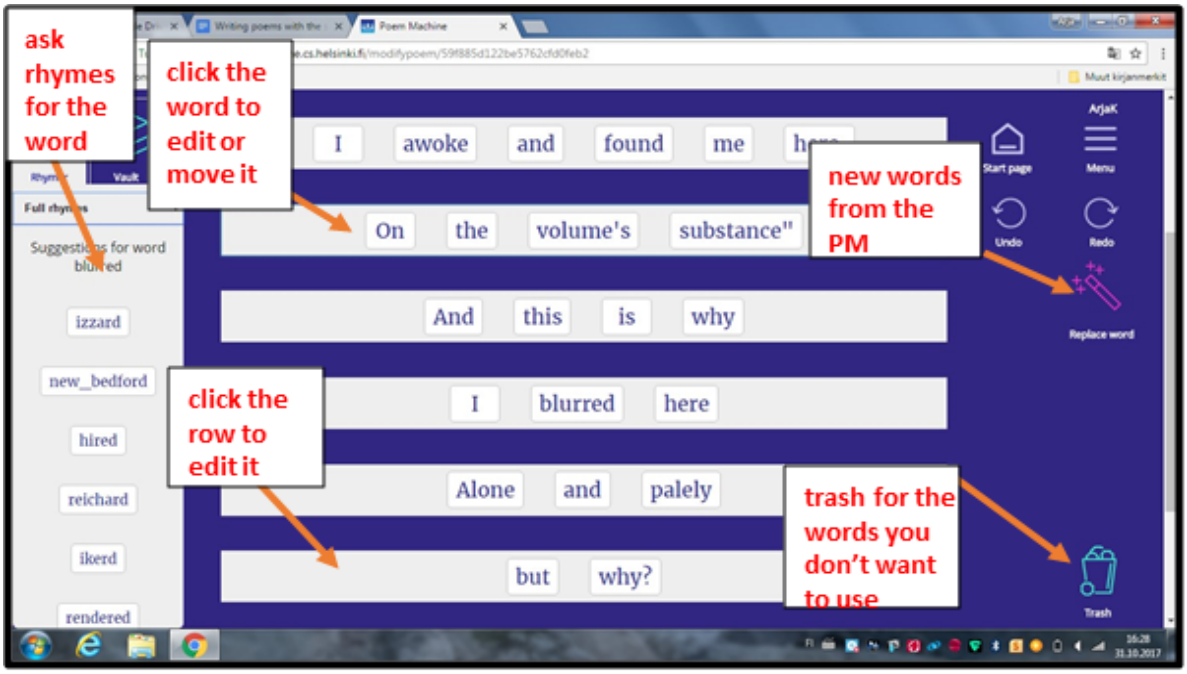
Participation in the research was voluntary. Permissions for students to participate in the study were obtained from their parents, after informing them about the purpose of the study and data collection procedures. Data were collected anonymously.

[1] Grades: 6 = moderate, 7 = satisfactory, 8 = good, 9 = very good, 10 = excellent

Apparatus

The Poetry Machine is a co-creative tool designed for writing poetry (Kantosalo et al., 2014), and it was created in a project investigating computational linguistic creativity. The Poetry Machine uses corpus-based methods to find associated words around an offered topic and then produces poetry about it (Toivanen et al., 2012). Thus, the Poetry Machine produces a nonsense draft poem, which has five lines. The nonsense structure and poetic features in draft poems provide affordances to the user, who can modify this draft via a colorful drag-and-drop interface by adding, moving, editing and deleting individual words and whole lines, and writing a new title to the poem; the Poetry Machine supports the writer by adding lines on request and suggesting new words, optionally with rhymes (assonance, consonance, full-rhymes, swap, alliteration) and meter. For research purposes, all user actions are recorded in log files, allowing investigation of students' poetry writing processes. The Poetry Machine user interface in Figure 1 depicts the main functions of the Poetry Machine and a poem produced by it.

Figure 1: *Sample screenshot illustrating a poem produced with the Poetry Machine*



Highlights of the main editing functions were added.

Pedagogical Design of the Lessons

The participating teachers planned three lessons (each of 45 minutes) in which the Poetry Machine was used. They explained to the students how to work with the Poetry Machine: how to select a topic for the poem from a list of themes and then modify the suggested draft poem via dragging and dropping words and lines, and how to ask for assistance about several poetic features or more material from the Poetry Machine. The teachers introduced the task of composing at least one poem during the first lesson. Each student worked alone and used the Poetry Machine with a laptop computer. In the second lesson, the students were first asked to compose a poem of their own, and then they worked in pairs examining each other's poems and discussing them. In the third lesson, the students worked in groups, and they were asked to present their Poetry Machine-supported poems to each other and discuss the features of the program they had used in writing the poems. Poetry was not taught as a discrete genre before the research. Therefore, the features and structures of poetry may have been unfamiliar to the students.

Data Collection

The study was based on two quantitative data sets: (1) The log data consisted of all the changes that students made to the poems, informing the researchers about the writing process; (2) Pre- and post-questionnaires indicated students' perceptions of literacy, and especially their perceptions of writing poems. The data for the study were collected in March - April 2017.

Log data. The log data contains the number of poems students wrote, as well as the number and type of changes they made to the draft poems produced by the Poetry Machine. In total, students wrote 228 poems.

Pre- and post-questionnaires about perceptions of writing poems. A pre-

questionnaire was created to investigate students' perceptions of literacy before they used the Poetry Machine. A pilot study was conducted with students in February 2017 to test the questionnaires, and it led to a few minor changes in the final questionnaire. The test was also used to create guidelines for participating teachers on how to use the Poetry Machine in their teaching and to ensure what the teacher's role during the investigation was to be. With the final questionnaire, we collected data related to enjoyment of literacy and self-estimated writing abilities. It consisted of five background questions and 24 statements: seven statements about perceptions of literacy, 16 about perceptions of poems and one about using a computer to support writing (see Appendix A). The statements about perceptions of literacy were based on the studies of Hamilton et al. (2013), and the statements about enjoyment of reading, writing, and poems on the studies of Wang (2012). The rest of the statements about students' writing abilities and difficulties were based on the first author's experiences as a teacher. Statements such as "A computer supports me in writing" and "A model of a poem would support me in writing a poem" were based on the hypothesis that the Poetry Machine supports students, because of the use of computer and draft poems the tool offers.

Students' perceptions of reading and writing poetry and other genres were surveyed with a 5-point Likert scale: (1 = *not at all;* 5 = *a great deal*). The items included positive statements such as "I enjoy poems" (Appendix A). Students' opinions of poems and writing were surveyed with a 4-point Likert scale which was selected to avoid students selecting a neutral alternative (1 = *completely disagree;* 4 = *completely agree*). The statements were such as "I think that I can write poems" (Appendix A). There was also an open-ended question of students' descriptions of poems.

The post-questionnaire was created to investigate students' perceptions of writing poems after they had written poems with the support of the Poetry Machine. It was administered

to evaluate the students' writing experience regarding the usage of the Poetry Machine. It consisted of five background questions and 14 statements which were based on hypothetical assumptions about the support provided by the Poetry Machine (see Appendix B). They included statements such as "The opportunity to edit a poem (with the Poetry Machine) supported me in writing". They were surveyed according to a 5-point scale (1 = *not at all;* 5 = *a great deal*) and 4-point Likert scale (1 = *completely disagree;* 4 = *completely agree*). There was also an open-ended question about students' experiences of using the Poetry Machine. A set of statements in both questionnaires was designed to compare possible changes in students' perceptions. Those statements were such as "A computer supports me in writing" / "The digital tool (the Poetry Machine) supported me in writing a poem", "I can / I was able to express myself by writing a poem". The open-ended questions in the questionnaires offered students an opportunity to describe their idea about poetry before they used the Poetry Machine, and their experience of writing with the support of the Poetry Machine after they had used it. These questions were as follows: in the pre-questionnaire "Describe a poem by using 1 - 3 adjectives" and in post-questionnaire "Describe in own words your experience of writing with the support of the Poetry Machine." The questionnaires were collected using electronic surveys via Google Forms. The students filled in the pre-questionnaire at the beginning of the first lesson and the post-questionnaire at the end of the third lesson. The response rate was 97 %.

Teacher data. Teachers kept a diary of the lessons during the investigation. Their instructions to the students and reflections were collected by email after the lessons in April 2017 and used to describe the context and the pedagogical design.

Data Analysis

Analysis from the log data: The number of poems and types of changes students made. The number of poems produced and the number and types of changes to the poems

were calculated from the log data of the Poetry Machine. It provided a summary of user actions for each poem which had been written with the Poetry Machine. The number of each type of change was calculated from both those summaries and manually using Excel software. The log data also provided information on the user ID of each writer and each poem. The number of poems was calculated according to these.

Analysis of questionnaires about perceptions of writing poems. The quantitative data arising from questionnaires were analyzed using descriptive statistics (Statistical Package for the Social Sciences, SPSS 25 software). We conducted Pearson correlational analyses to assess relationships between students' perceptions of enjoyment of literacy, the ability to write different texts, perceptions of poetry, self-estimated interest in the subject, and grades in the subject. Comparisons between the students' perceptions of poetry writing before and after using the Poetry Machine were made using paired-samples t-test and Wilcoxon t-test. Comparisons between the answers from male and female participants were made using independent samples t-tests. Both the independent samples t-test and one-way ANOVA were conducted to find out whether the students who wrote many poems had different perceptions of poems and writing. The answers to the open questions in the questionnaires were analyzed by combining them into three categories regarding the similarity of descriptive words. The categories were (a) positive descriptive words (for example a poem is gentle and beautiful; writing with the support of the Poetry Machine was fun and nice), (b) negative descriptive words (for example boring, hard, and dull), and (c) answers without words (for example empty space).

Results

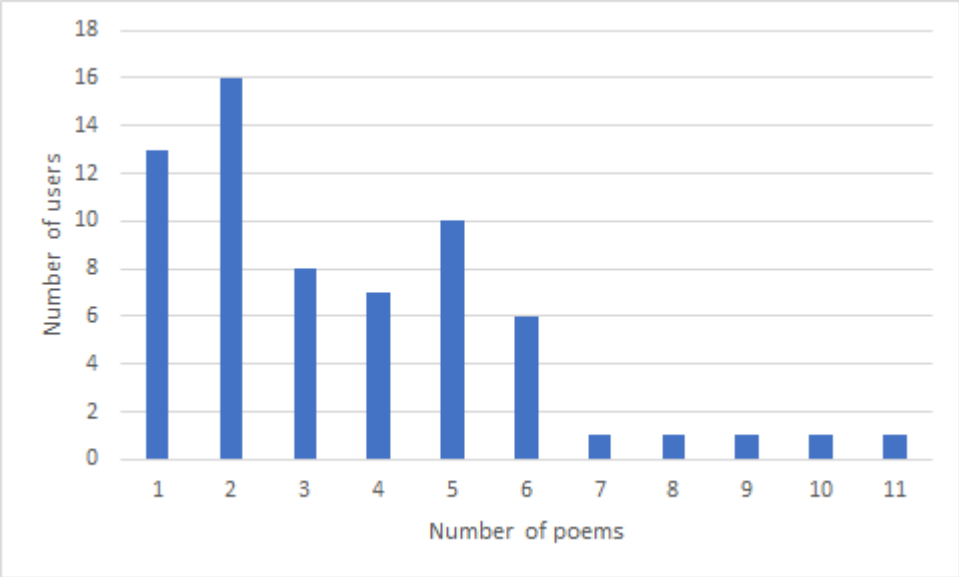
Results of the Students' Use of the Poetry Machine

The first research question framing this study was: *How do students use the Poetry Machine?* In the following we present the number of poems written with the support of the

Poetry Machine per student, followed by the number and type of changes that the participants made to the poems.

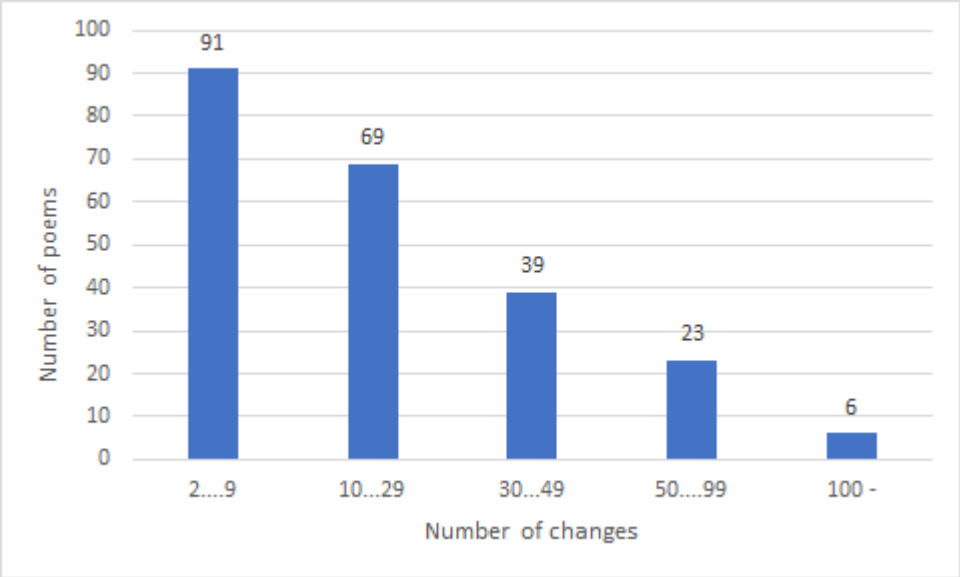
The number of poems. The number of poems per user is depicted in Figure 2. The participants wrote 228 poems. On average, they wrote 3.5 poems each. Eleven students, of whom four were male, wrote more than five poems (6 - 11). A few students had forgotten their usernames and took a new one, and therefore the number of users was higher (*N*=65) than the number of the participants (*N*=61). Thus, the number of poems that those users wrote is lower than it would otherwise have been. Per the results of the Pearson correlation tests, no significant correlation was found between gender or grades in the Finnish language and literature subject and the number of poems written.

Figure 2*: Number of poems per user*



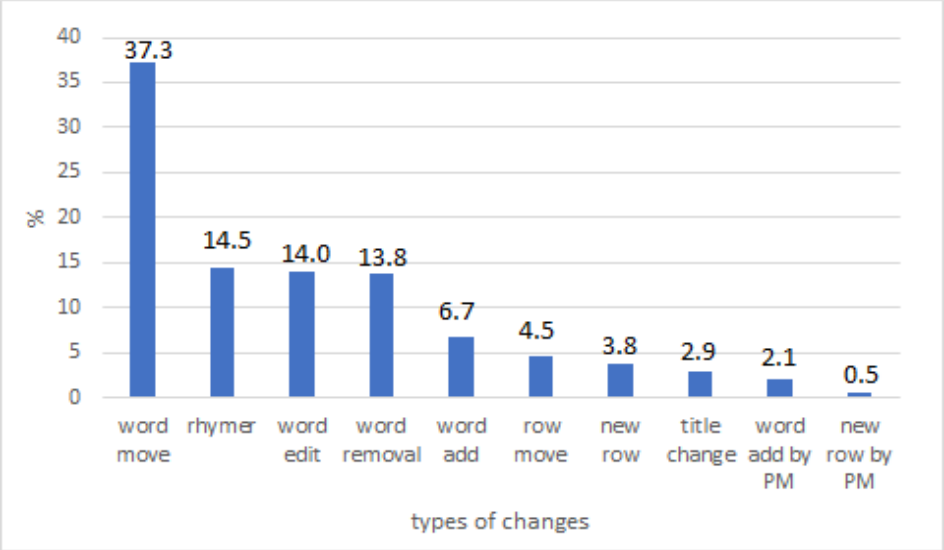
The changes made to the poems originally produced by the Poetry Machine. The number of changes that the participants made to the poems varied from 2 to 125 per poem (Figure 3). The mean number of changes was 24 per poem. For 60% of the poems, students made 10 or more changes.

Figure 3: *The number of changes made to the poems during the writing process of each poem (f=228)*



The Poetry Machine offers several functions for editing poems (cf. chapter “Apparatus”). Figure 4 shows the relative frequencies of each type of change. The percentage of the different types of change was calculated from all the changes made to the poems. Thus, one poem could have numerous instances of words being moved, and each of these was calculated.

Figure 4: *Percentage of changes that students made to the poems*



The most used operation was to move words (*37%* of all the changes). The students also edited the suggested words. However, they seldom asked for new lines or words from the Poetry Machine. They also asked the rhymer to assist them, but its suggestions were rarely accepted in the final poems (not shown in the figures). The title was changed in *31%* of the poems, which is an essential change that might provide a new meaning to a poem. In most cases, the new title was shorter than the original, such as replacing "Mothers of your own" with “Love”. In some cases, the new title was more suitable to participants' own life, such as the substitution of the title “Free airplanes” by “Mopeds are yes, but cars are the best”.

The number of changes in students’ poems varied extensively (2 - 125). One of the students made 125 changes to a draft poem, and the final poem described the difficult process of poetry writing. The draft poem was a nonsense poem about an airport interested in a bicycle. The student moved words, added new words and lines, and finally, there was nothing left of the original poem. (The poem has been translated from Finnish to English by the first author. In the translation, some features of the original poem have been lost.)

I don’t know what to do
because this is so difficult!
The teacher told me to produce a poem
and that is what I’m trying to do.
But the only thing in my head is food.
because I’m hungry!
The next three lessons we’ll have handcraft arts
but this will not do.
Let’s go on with this
go on, go on
This is still dull!

Does someone imagine

that I will survive

I can tell you straight that I won't!

I'm still thinking all the time

why am I doing this?

Students' Perceptions of Poems before Writing with the Poetry Machine

The second research question framing this study was two-fold: How does writing with the support of the Poetry Machine influence students' perceptions of poetry writing, and how do these perceptions differ according to students' perceptions of literacy, grades in the subject, and gender.

First, we have presented the results of the students' perceptions of poems and literacy and compared the results between perceptions of literacy, grades, and gender before writing with the Poetry Machine. We have then presented the results, and finally, we have compared the results before and after the writing process.

The first set of analyses examined students' perceptions of poetry and reading and writing other texts. Table 1 describes the evaluation responses regarding students' perceptions of enjoyment of reading, writing and poetry and Table 2 presents an evaluation of responses regarding students' opinions of poems and writing, and self-estimated ability to write poems and other texts before they used the Poetry Machine.

Table 1: *Means, and Standard Deviations of Students' Evaluation Responses Regarding Perceptions of Enjoyment of Reading Writing and Poetry*

Statement	M	SD
I enjoy reading.	3.2	1.1

I enjoy writing.	3.0	0.9
I understand poems.	2.8	0.9
I enjoy poems.	2.0	0.9
I write poems during free time.	1.4	0.7
I read poems during free time.	1.4	0.7

Note. 1=not at all, 2=little, 3=somewhat, 4=much, 5=a great deal

Table 2: *Means, and Standard Deviations of Students' Evaluation Responses Regarding Opinions of Poems and Writing and Abilities to Write*

Statement	M	SD
I think a poem must not be too long.	2.9	1.1
I think that I can write stories.	2.7	0.9
I think I have good ideas in writing and composing a text.	2.6	0.9
I think that I can write essays.	2.6	1.0
I think that it is nice to interpret poems.	2.0	1.0
I think that I can write poems.	1.9	1.2

I think that a poem must not be too easy.	1.9	0.9
I think that it is fun to write poems.	1.7	0.9
I can express myself by writing a poem.	1.5	0.9

Note. 1=completely disagree, 2=slightly disagree, 3=slightly agree, 4=completely agree

The students reported that they enjoyed reading (*M=3.2*) and writing (*M=3.0*), but poems less so (M=2.0), and most of them did not read or write poems (*M=1.4*). Nor did the students think that writing a poem was easy or fun, or that they could write or interpret poems or express themselves by writing poems. They disagreed slightly with all those statements before they used the Poetry Machine.

The results of the Pearson correlation tests between students' perceptions of enjoyment of literacy, the ability to write different texts and the relationship to poetry are depicted in Table 3.

Table 3: *Correlations between Enjoyment of Reading and Writing, and Students' Self-Estimated Ability of Writing Different Texts, and Understanding Poems*

Statement	I enjoy reading.	I enjoy writing
I enjoy reading.	1.0	.510**
I enjoy poems	.258*	.385**
I write own poems.	.237	.337**
I can understand poems.	.354**	.402**

I read poems during my free time.	.188	.181
I think that I can write poems.	.118	.395**
I think I can write essays.	.299*	.291*
I think I can write stories.	.343**	.359**

Note. ** Correlation is significant at the 0.01 level (two-tailed)
* Correlation is significant at the 0.05 level (two-tailed)

According to the results of the Pearson correlation tests (Table 3), positive perceptions of both reading and writing correlated significantly with enjoyment of and understanding poems. Nevertheless, those who enjoyed reading thought that they could not write poems, although they reported an ability to write other texts. In contrast, the results showed that those students who reported enjoyment of writing thought that they could also write poems. In addition, they said that they write their own poems.

Results of correlation between students' perceptions and the grades in the subject.

According to the results of the Pearson correlation tests, significant correlations were observed between students' self-estimated interest in the Finnish language and literature subject and positive perceptions of reading ($r=.38$; $p=.003$), writing ($r=.44$; $p<.001$), and poems ($r=.27$; $p=.03$). Further analysis showed significant and positive correlations between the grade and students' self-estimated interest in the subject ($r=.60$; $p<.001$). However, even those students who were interested in the Finnish language and literature subject, and had higher grades in it, thought that they were unable to write poems. Nor did they read poems during their free time.

Differences between the perceptions of male and female participants. Further statistical tests (Independent Samples T-test) revealed statistically significant mean differences (MD) between the answers from male and female participants to the statements "I enjoy poems"

(*MD 0.6, t(55)=2.5; p=0.02),* "I read poems during my free time" (*MD= 0.6, t(55)=3.2; p=.002*), "It is fun to write poems" (*MD 0.6, t(55)=2.5;p=0.014)*, and "It is nice to interpret poems" (*MD 0.8, t(55) = 3.2; p=.003)*. The results showed that male participants enjoyed poems more, read them more during their free time, thought that poetry writing is somewhat fun and enjoyed interpreting poems more than female participants did.

Students were also asked to describe a poem by using three adjectives. Despite the earlier-mentioned dislike of poems, most of those adjectives (*63%*) were positive (such as *fun, gentle, beautiful*), and *32%* of them could be negative (such as *difficult, boring)*. The rest of the adjectives (*5%*) were about the length of a poem (*short*).

Students' Perceptions of Poems after Writing with the Poetry Machine

Results on students' perceptions from the post-questionnaire are presented next and compared between the male and female participants, and the results of those who wrote more poems and those who wrote fewer poems. As shown in Table 4, students reported that the Poetry Machine and having the opportunity to edit poems assisted them much in writing. They also considered that the Poetry Machine supported them somewhat in managing the process of writing a poem, that the poems were superior with its support, and that writing was somewhat fun.

The results of a series of Independent Samples T-tests (Table 4) revealed that there were differences in means between male and female participants' evaluation responses regarding the support of the Poetry Machine. The difference was statistically significant as shown in Table 4.

Table 4 : *Means (M) and standard deviations (SD) of the students' evaluation responses regarding perceptions of the support of the Poetry Machine and differences between male and female students' evaluation responses in the post-questionnaire*

Statement	All	Female	Male	Independent Samples T-test	
				t(55)	Sig.
The Poetry Machine supported me to write a poem.[a]	3.7(1.1)	3.4(1.3)	4.2(0.8)	2.5	.02*
The option to edit a poem with support of the Poetry Machine supported me. [a]	3.5(1.2)	2.9(1.3)	3.7(1.1)	0.4	.67
The Poetry Machine supported to manage in writing a poem. [b]	3.4(1.3)	3.0(1.4)	3.9(0.8)	3.5	.001***
I think that the poem was superior with the support of the Poetry Machine. [b]	3.4(1.2)	3.1(1.2)	3.6(1.1)	1.8	.04*
A model of a poem supported me in writing a poem.[a]	3.2(1.3)	2.9(1.2)	3.6(1.3)	2.1	.04*
It was easy to begin to write, because I got words ready from the Poetry Machine.[a]	3.3(1.1)	3.1(1.2)	3.6(1.0)	1.5	.02*
The Poetry Machine supported me in choice of words.[a]	3.2(1.2)	3.0(1.2)	3.7(1.1)	3.0	.01*
The rhymer supported me in writing.[a]	3.1(1.3)	2.8(1.2)	3.7(1.2)	2.9	.01**
Writing poems with the support of the Poetry Machine was fun.[b]	2.8(0.9)	2.6(1.0)	3.1(1.0)	2.1	.04*
The option to get support from the Poetry Machine with the meter supported me in writing.[a]	2.6(1.3)	2.4(1.4)	3.1(1.2)	2.0	.06
I was able to express myself by writing a poem with the support of the Poetry Machine.	2.2(1.0)	2.0(1.0)	2.5(1.0)	2.1	.04*

Note. [a] 1=not at all, 2=little, 3=somewhat, 4=much, 5=great deal

[b] 1=completely disagree, 2=slightly disagree, 3=slightly agree, 4=completely agree
* p < 0.05 (two-tailed) ** p < 0.01 (two-tailed) ***p < 0.001 (two-tailed)

In the post-questionnaire, the Pearson correlation tests revealed that those who wrote more poems considered that the Poetry Machine had supported them in beginning to write a poem (*r=0.7, p=.017*) and in writing superior poems (*r= 0.67, p=.036*). The correlations were positive and statistically significant. Instead, those who wrote fewer poems reported that it did not support them to begin writing poems or writing superior poems. There were no other statistically significant correlations between the number of poems written and the answers in the post-questionnaire. T-tests also revealed that those who wrote more than five poems (6–11) with the Poetry Machine enjoyed writing (*M=3.6, SD=0.9*) and already understood poems (*M= 3.5, SD=0.8*) before they wrote poems. Evaluation responses of those who wrote fewer poems were not as positive (*M=2.9, SD=0.9; M=2.7, SD=0.9*). The differences between the groups were statistically significant (enjoyment of writing: *t(59)=-2.6, p=0.01, two-tailed;* understanding poems*: t(59)=-2.6, p=0.01, two-tailed*). According to the one-way ANOVA test, the differences in evaluation responses between pre- and post-questionnaires were also statistically significant in the following statements: “I can express myself by writing poems” (*F(1, 60)=3.99, MS=3.25, p=.05*), “I think that it is fun to write poems” (*F(1, 60)=3.84, MS=3.84, p=.03*), “I think that it is nice to interpret poems” (*F(1, 60)=5.72, MS=5.69, p=.02*), and “I think that a poem must not be too easy” (*F(1, 60)=4.10, MS=4.91, p=.03*).

Comparison of Students’ Perceptions before and after Writing with the Support of the Poetry Machine

We compared identical statements in the pre- and post-questionnaires aiming to study whether the participants perceived that the computer/Poetry Machine supported them in beginning to write a poem, to write it, to express themselves by writing a poem, and by offering

a model of a poem. The relationships between the answers to these statements were analyzed by using paired-samples t-tests and tested by using the related samples Wilcoxon signed-rank test, which confirmed that the differences between the responses were statistically significant (significance level .05). As shown in Table 5, the results reveal that the Poetry Machine supported students to begin to write and express themselves by writing poems.

Table 5: *Comparison of the Results of Paired Samples T-tests for the Same Statements in the Pre- and Post-questionnaires*

Statement	Pre-questionnaire	Post-questionnaire	Paired samples t-test	
	M(SD)	M(SD)	t	Sig.
It is/was easy to begin to write a poem.	1.6(.89)	3.0(.90)	t(47)=7.6	<.001**
I can/was able to express myself by writing a poem.	1.5(.89)	2.2(1.0)	t(56)=3.7	.001***
A model of a poem would support me in writing a poem.	3.1(1.2)	3.2(1.4)	t(55)=.24	.81
A computer/the Poetry Machine supports/supported me in writing.	3.9(1.3)	3.7(.15)	t(54)=.98	.33

Note. * p < 0.05 (two-tailed) ** p < 0.01 (two-tailed) ***p < 0.001 (two-tailed)

In the post-questionnaire, the participants had the opportunity to describe the experiences of writing with the support of the Poetry Machine. Most of the words (*69%*) described the experience as positive, such as nice, easy, fun, and creative. Only *14%* of the description words were negative, such as dull and difficult, and *17%* of the answers could not be considered either positive or negative, such as empty space.

Discussion

In this study, we investigated whether a digital tool supporting creative writing, the Poetry Machine, assisted lower secondary students in the challenging task of poetry writing. The Poetry Machine's role was one of assistive technology.

Developing Poems by Using the Poetry Machine like a Word Processor and as a Source of Ideas

The first research question sought to explore how students use the Poetry Machine. The students reported that the Poetry Machine and the capacity to revise poems assisted them much in writing. However, the students did not use all the options to develop poems with the support of it. Most of the changes made to the poems were those that could also be done by a word processor, that is, moving, editing, and adding words. This result may be partly explained by the participants being familiar with writing with word processors, and not having experience with intelligent features of digital tools, like suggestions for new words and lines, and even with meters and rhymes, as offered by the Poetry Machine. This finding is consistent with that of Ching (2018) who found in his study that students' routines had been shaped by the word processing software they were accustomed to using. In our study, another explanation is that the students considered the draft poems as affordances and as a source of ideas, words, and lines from which they revised the poems. There were also differences in the students' writing processes: some of them made few changes to the draft poems while others developed them a lot. The commitment to the writing task varied.

Responding to the first research question, it was found that the option to edit poems with the Poetry Machine supported students in writing poems, although they did not use its intelligent features. This study raises the need to have more opportunities for students to practice writing with digital tools with intelligent features.

Writing with the Support of the Poetry Machine influenced Students' Perceptions of writing Poems

The second research question sought to explore changes in students' perceptions of writing poems after they had used the digital Poetry Machine. Before the writing experience, the students reported that they enjoyed poems only a little, that most of them did not read or write

poems, and writing a poem was not easy or fun. These results reflect those of Fleming (1992), Hawkins & Certo (2014) and Wilson (2007) who also found that poetry is feared and is unpopular in schools, and students experience poetry writing as being difficult. After writing with the Poetry Machine, the students reported that the draft poems the artificial intelligence -based tool provided them with made it easier to begin and to write a poem, and supported them somewhat in their writing process. This result seems to be consistent with studies by Certo (2015) and Wilson (2007), who argued that offering models of poems provides students with support in the potentially challenging task of finding structure and style in poetry. The writing was also easy and fun for most of the students in our study. Thus, the Poetry Machine brought enjoyment into writing. The writing was akin to playing with the digital tool and could be considered more enjoyable than writing with pen and paper without the assistance of a digital tool.

The second research question also sought to explore how students' perceptions differ according to their perceptions of literacy, grades in the subject, and gender. Findings revealed that those who wrote many poems with the Poetry Machine thought that it supported them to begin or to write superior poems, whilst those who wrote fewer poems reported that it did not support them in these competencies. On the other hand, those who wrote more poems had more positive perceptions of poems and they had even written their own poems earlier. Obviously, there are more challenges in learning to write poems even with support of digital tools among those who do not enjoy reading, writing, or poetry.

In our study, we did not find a significant difference between students' perceptions of the support of the Poetry Machine per their different grades in the Finnish language and literature subject. It supported all the students equally, irrespective of their grade. This outcome is contrary to that of Chong & Lee (2012) in their study of creative writing with the support of the Storyworld application. They found that academically low-achieving students produced more

significant improvements than academically high-achieving students. However, it can be assumed that in our study, we could not find differences between perceptions per grades because of the relatively high grade achieved by most of the students.

One interesting finding was that the male adolescents thought that the Poetry Machine supported their poetry writing more than the female adolescents did. These results reflected those of Hawkins & Certo (2014) who found that it was possible to create an environment in which male students were willing to engage with poetry and results of Hanratty's investigation (2011), which argued that male students are at least as capable as female students to respond to the demands of poetry. Studies by Merisuo-Storm (2006) and Troia et al. (2013) have suggested that female students' writing abilities are better than male students' and gender influences on performance goal orientations. In our study, we found that with the support of digital tools we can narrow the gap between genders. An explanation for this could be that the male students like to use computers in learning and may also have liked the game-like interface of the Poetry Machine. This finding reflected that of Merisuo-Storm (2006) who suggested that the use of computers can motivate male students to write. Thus, with support of innovative digital tools and use of technology we could support especially male students' writing processes.

We can respond to the second research question that writing with the Poetry Machine influenced the participants' perceptions of writing poems so that contrary to their earlier perceptions, most of them thought that writing with the digital tool was easy and fun.

Limitations of the Present Study

A limitation of this study is that the study, as a case study, was conducted in only one school over a very short time, and the generalizability of the results is thus limited. Still, the authors believe that the findings can inform considerations about how tools like the Poetry Machine support students' poetry writing because the participated school followed the general

Finnish curriculum and students were committed to the investigated process. Furthermore, the results are related to teachers' high level of engagement in this study, and because almost all the students had good grades in Finnish language and literature. The results might have been different in another school.

The students did not use all the features of the Poetry Machine. The results could have been different if they had known more about the possible ways to develop their poems with the Poetry Machine. For this, they should have had a better introduction to the features of the Poetry Machine as a source of both new words and lines, and as an aid with the meter and rhymes of the poems. The number of specific actions, including moves and edits presented by the numbers in the log data, may also be greater than the number of truly completed operations under these names since the logging functionality also logs events that have not been completed. Therefore, a student opening a word to edit it, but then changing his/her mind, would be nevertheless logged as an edit by the system.

Furthermore, the questionnaire had some poetic concepts that the students apparently did not recognize. For example, they did not use the meter at all and did not accept the suggestions of the rhymer to their final poems. Nevertheless, they reported that both the meter and the rhymer supported them in writing somewhat. They may have misunderstood these concepts in the statements.

Conclusions and Future Prospects

Our findings may assist in understanding the challenges of learning poetry writing and use of digital tools to assist writing at school. The Poetry Machine provided the most support to those students who already enjoyed writing. It is possible that with a more extensive use of the artificial intelligence -based features of the digital tool, all of them could have benefited more from it.

Especially the male adolescents experience was that the digital tool supported them in writing. An explanation for this could be that the male students like to use computers in learning and may also have liked the game-like interface of the Poetry Machine. This finding reflected that of Merisuo-Storm (2006) who suggested that the use of computers can motivate male students to write. Thus, with support of innovative digital tools and use of technology we could support especially male students' writing processes.

Students' writing processes were creative to some extent, and many of the characteristics of a creative process (Sawyer, 2018) appeared: students' ideas emerged when engaged in the process; the tool had an essential role as a source of ideas offering affordances from which to start revising of the poems; the process was iterative, and it included experimentation, but there were also dead ends and failures.

The role of the Poetry Machine in students' poetry writing processes is interesting. It might have been a writing tool and an inspirer, but it also might have alienated students from the poems: the text was no longer only an outcome of the student and the personal connection was cut. This might have assisted the shyness or sensitivity of a personal outcome; now it was shared with the digital tool as a joint outcome.

In our study, the students also worked collaboratively in pairs and in groups discussing and peer reviewing each other's poems. All digital writing tools can be used online, but as well as the writing process, collaborative working could be done in online environments using collaborative digital tools when students draw on their collective strengths (Krishnan et al., 2018). Online tools can also be used to build the student's common discussion and for their part they could wake enthusiasm and creativity.

Digital tools, such as the Poetry Machine, offer opportunities to motivate students in online learning. However, the young students need support both in face-to-face and online

learning environments. Especially online learning requires good instruction from teachers, although in the preliminary results from the spring 2020 Finnish students did not report problems in their digital competence, when in many countries teaching and learning routines changed due to the pandemic and online education was temporarily substituted face-to-face teaching (KARVI, 2020; Moore-Adams et al., 2016). Ilomäki & Lakkala (2020) have found in their study that the students liked the online learning, but teachers' pedagogic solutions affect how the online teaching succeeds (see also KARVI, 2020).

In this study, we focused on the quantitative analysis of the students' poems. We found that the students' commitment to the writing processes varied and some of them made much more changes to the draft poems than others. In further investigations, it would also be relevant to consider the qualitative features and structures of the poems and changes students made to them, to develop a full picture of the use and usefulness of the Poetry Machine. It would also be relevant to consider poetry writing with support of other digital tools and collaboratively. Overall, the writing of poems is not only writing but enhancing creativity as well as thinking skills.

References

Aviram, R., & Eshet-Alkalai, Y. (2006). Towards a theory of digital literacy: Three scenarios for the next steps. *European Journal of Open Distance E-Learning, 1.* Retrieved from http://www.eurodl.org/?p=archives&year=2006&halfyear=1&article=223

Baird, C., & Henninger, M. (2011). Serious play, serious problems: Issues with eBook applications. *Cosmopolitan Civil Societies: An Interdisciplinary Journal, 3*(2), 1–17. https://doi.org/10.5130/ccs.v3i2.1881.

Blikstad-Balas, M., Roe, A., & Klette, K. (2018). Opportunities to write: An exploration of student writing during language arts lessons in Norwegian lower secondary classrooms. *Written Communication, 35*(2), 119–154. https://doi.org/10.1177/0741088317751123.

Buckingham, D. (2015). Defining digital literacy - What do young people need to know about digital media? *Nordic Journal of Digital Literacy Special Issue 2006 - 2016*, 21–34. Retrieved from https://www.idunn.no/file/pdf/66808577/dk_2015_Jubileumsnummer_pdf

Certo, J. (2015). Poetic language, interdiscursivity and intertextuality in fifth graders' poetry: An interpretive study. *Journal of Literacy Research*, *47*(1), 49–82. https://doi.org/10.1177/1086296X15577183.

Ching, K. L. (2018). Tools Matter: Mediated Writing Activity in Alternative Digital Environments. *Written Communication, 35*(3), 344–375. https://doi.org/10.1177/0741088318773741

Chong, S.X., & Lee, CS. (2012). Developing a pedagogical-technical framework to improve creative writing. *Educational Technology Research and Development, 60*(4), 639 – 657. https://doi.org/10.1007/s11423-012-9242-9.

Coldwell-Neilson, J. (2017). Digital Literacy – a driver for curriculum transformation. In R.G. Walker & S.B. Bedford (Eds.), *Research and Development in Higher Education:*

Curriculum Transformation, *40*, 84–94. Retrieved from https://www.researchgate.net/publication/321606401.

Dredger, K., Nobles, S., & Martin, J.M. (2017). Digital Poetry Practicum: Preservice English Language Arts Teachers' Dispositions of New Literacies. *Journal of Literacy and Technology, 18(1), 571*–203. *https://www.researchgate.net/publication/315675705*

Edwards-Groves, C. (2012). Interactive creative technologies: Changing learning practices and pedagogies in the writing classroom. *Australian Journal of Language and Literacy*, *35*(1), 99–113. Retrieved from https://researchoutput.csu.edu.au/files/8856503/43931postpub.pdf

Erstad, O. (2015). Educating the digital generation - exploring media literacy for the 21st century. *Nordic Journal of Digital Literacy, Special Issue 2006–2016*, 85–102. Retrieved from https://www.idunn.no/dk/2015/Jubileumsnummer

European Union [EU] High Level Group of Experts on Literacy. (2012a). *Final Report of EU High Level Group of Experts on Literacy.* (Publications Office of the European Union 2012). Retrieved from http://ec.europa.eu/dgs/education_culture/repository/education/policy/school/doc/literacy-report_en.pdf.

European Union [EU] High Level Group of Experts on Literacy. (2012b). *Executive Summary of EU High Level Group of Experts on Literacy.* (Publications Office of the European Union 2012). Retrieved from: http://ec.europa.eu/assets/eac/education/policy/school/doc/literacy-hlg-exec-sum_en.pdf

The Finnish National Agency for Education [FNAE]. The National core curriculum for basic education in 2014. Retrieved from https://www.oph.fi/english/curricula_and_qualifications/basic_education

Fleming, M. (1992). Pupil's perceptions of the nature of poetry. *Cambridge Journal of Education*, *22*, 31–41 https://doi.org/10.1080/0305764920220104

Hague, C., & Williamson, B. (2009). Digital participation, digital literacy and school subjects. A review of the politicies, literature and evidence. Bristol: Futurelab. Retrieved from http://archive.futurelab.org.uk/resources/documents/lit_reviews/DigitalParticipation.pdf

Hall R., Atkins L., & Fraser J. (2014). Defining a self-evaluation digital literacy framework for secondary educators: the DigLit Leicester project. *Research in Learning Technology, 22*, 1–17. http://dx.doi.org/10.3402/rlt.v22.21440.

Hamilton E.W., Nolen S.B., & Abbott R.D. (2013). Developing measures of motivational orientation to read and write: A longitudinal study. *Learning and Individual Differences 28,* 151–166. https://doi.org/10.1016/J.LINDIF.2013.04.007.

Hanratty, B. (2011). Poetry and gender: A comparative evaluation of boys' and girls' responses to poetry at key stage 4 in northern ireland. *Research Papers in Education, 26*(4), 413-426. https://doi.org/10.1080/02671522.2010.483525

Hawkins, L. K., & Certo, J. L. (2014). It's something that I feel like writing, instead of writing because I'm being told to: Elementary boys' experiences writing and performing poetry. *Pedagogies: An International Journal, 9*(3), 196–215. https://doi.org/10.1080/1554480X.2014.921857

Howell, E. (2018). Scaffolding multimodality: writing process, collaboration and digital tools. *English Teaching: Practice & Critique, 17(2),* 132–147. https://doi.org/10.1108/ETPC-05-2017-0053

Ilomäki, L., & Lakkala, M. (2020). Finnish upper secondary school students' experiences with online courses. *Education in the North* 27(2), 73–91. https://doi.org/10.26203/jsaz-8714

Kamberelis, G. (1999). Genre development and learning: Children writing stories, science reports and poems. *Research in the Teaching of English, 33,* 403–463. Retrieved from http://www2.ncte.org/resources/journals/research-in-the-teaching-of-english/.

Kang, G. Y. (2018). Playing with digital tools with explicit scaffolding. *Reading Teacher, 71*(6), 735–741. https://doi.org/10.1002/trtr.1672

Kantosalo, A., Toivanen, J.M., Toivonen, H., & Xiao, P. (2014). From isolation to involvement: Adapting machine creativity software to support human-computer co-creation. In S. Colton, D. Ventura, N. Lavra, & M. Cook (Eds.), *Proceedings of the Fifth International Conference on Computational Creativity,* 1–7. http://computationalcreativity.net/iccc2014/

KARVI, 2020. Poikkeuksellisten opetusjärjestelyjen vaikutukset tasa-arvon ja yhdenvertaisuuden toteutumiseen Osa I: Kansallisen arvioinnin taustaraportti, synteesi ja tilannearvio valmiiden aineistojen pohjalta [The effects of exceptional teaching arrangements in realized equality. Part I: The background report of national assessment, synthesis and estimation based on existing data]. Kansallinen arviointikeskus. 7.5.2020. Retrieved 1.11.2020 from https://karvi.fi/app/uploads/2020/05/Poikkeuksellisten-opetusj%C3%A4rjestelyjen-vaikutukset-osa-I-Karvi-7.5.2020-1.pdf

Kelly, A. (2005). ‘‘Poetry? Of course we do it. It’s in the National Curriculum.’’ Primary children’s perceptions of poetry. *Literacy 39* (3), 129–134. https://doi.org/10.1111/j.1467-9345.2005.00410.x

Krishnan, J., Black, R.W., & Olson, C. B. (2020). The power of context: Exploring teachers’ formative assessment for online collaborative writing. *Reading & Writing Quarterly*, 1–20. https://doi.org/10.1080/10573569.2020.1764888

Lankshear, C., & Knobel, M. (2015). Digital literacy and digital literacies: Policy, pedagogy and research considerations for education. *Nordic Journal of Digital Literacy Special Issue 2006 - 2016*, 8–20. https://www.idunn.no/file/pdf/66808577/dk_2015_Jubileumsnummer_pdf

Merchant, G. (2007). Writing the future in the digital age. *Literacy, 41*(3), 118–128. *http://dx.doi.org/10.1111/j.1467-9345.2007.00469.x*.

Merisuo-Storm, T. (2006). Girls and boys like to read and write different texts. *Scandinavian Journal of Educational Research, 50(2),* 111–125. *https://doi.org/10.1080/00313830600576039*

Moore-Adams, B.L, Jones,W.M., & Cohen, J. (2016) Learning to teach online: a systematic review of the literature on K-12 teacher preparation for teaching online. *Distance Education, 3(3),* 333–348. *https://doi.org/10.1080/01587919.2016.1232158*

Myhill, D., & Wilson, A. (2013). Playing it safe: Teachers' views of creativity in poetry writing. *Thinking Skills and Creativity 10*, 101–111. http://dx.doi.org/10.1016/j.tsc.2013.07.002

Niemi, H., & Multisilta, J. (2016). Digital storytelling promoting twenty-first century skills and student engagement. *Technology, Pedagogy and Education, 25(4)*, 451–468. https://doi.org/10.1080/1475939X.2015.1074610

Nobles, S., & Paganucci, L. (2015). Do Digital Writing Tools Deliver? Student Perceptions of Writing Quality Using Digital Tools and Online Writing Environments. *Computers and Composition, 38,* 16–31. https://doi.org.libproxy.helsinki.fi/10.1016/j.compcom.2015.09.001

OECD (2010). PISA 2009 assessment framework: Key competencies in reading, mathematics and science. Programme for International Student Assessment [PISA], *OECD Publishing*, Paris. http://dx.doi.org/10.1787/9789264062658-en.

Programme for International Student Assessment [PISA]. (2019). PISA 18 first results - Finland among top performers. http://urn.fi/URN:ISBN:978-952-263-684-3

Sawyer, K. (2018). Teaching and learning how to create in schools of art and design. *Journal of the Learning Sciences, 27 (1)*, 137–181. https://doi.org/10.1080/10508406.2017.1381963

Sigvardsson, A. (2017). Teaching poetry reading in secondary education: Findings from a systematic literature review. *Scandinavian Journal of Educational Research,* 61(5), 584–599. https://doi.org/10.1080/00313831.2016.1172503

Sigvardsson, A. (2019). Don't fear poetry! secondary teachers' key strategies for engaging pupils with poetic texts. *Scandinavian Journal of Educational Research, (63)*, 1–14. https://doi.org/10.1080/00313831.2019.1650823

Smith, A. M. (2010). Poetry performances and academic identity negotiations in the literacy experiences of seventh grade language arts students. *Reading Improvement, 47*(4), 202–218. Retrieved from https://helka.finna.fi/PrimoRecord/pci.ericEJ971942

Toivanen, J., Toivonen, H., Valitutti, A., & Gross, O. (2012). Corpus-based generation of content and form in poetry. In M. L. Maher, K. Hammond, A. Pease, R. Pérez y Pérez, D. Ventura, & G. Wiggins (Eds.), *Proceedings of the Third International Conference on Computational Creativity,* 175–179. Dublin: University College Dublin.

Troia, G.A., Harbaugh, A.G., Shankland, R.K., Wolbers, K.A., & Lawrence, A.M. (2013). Relationships between writing motivation, writing activity, and writing performance: effects of grade, sex, and ability. *Reading and Writ*ing, *26(1)*, 17–44. https://doi-org.libproxy.helsinki.fi/10.1007/s11145-012-9379-2

Wang, A.Y. (2012). Exploring the relationship of creative thinking to reading and writing. *Thinking Skills and Creativity, 7*, 38–47. https://doi.org/10.1016/j.tsc.2011.09.001

Wilson, A. C. (2007). Finding a voice? Do literary forms work creatively in teaching poetry writing? *Cambridge Journal of Education, 37*, 441–457. https://doi.org/10.1080/03057640701546789.

Wolf, S. (2006). The mermaid's purse: Looking closely at young children's art and poetry. *Language Arts, 84*(1), 10–20. Retrieved from https://search-proquest-com.libproxy.helsinki.fi/scholarly-journals/mermaids-purse-looking-closely-at-young-childrens/docview/196929064/se-2?accountid=11365

Xerri, D. (2013). Poetry writing in the post-16 English curriculum. English Teaching: Practice and Critique 12(2), 140–155. http://education.waikato.ac.nz/research/files/etpc/files/2013v12n2dial1.pdf

Appendix A: The Prequestionnaire for the Participants

(translated from Finnish to English)

Answer to the following questions by selecting the alternative that best describes you as a reader or an author.

(Scale in the statements 1 – 3 and 5 – 7: 1 = not at all; 2 = little; 3 = somewhat; 4 = much; 5 = a great deal; scale in the statements 4 and 8: 1=never; 2=rarely; 3=monthly;4=weekly;5=daily)

1. I enjoy reading.

2. I enjoy writing.

3. I enjoy poems.

4. I write own poems.

5. I can understand poems.

6. A computer supports me in writing.

7. A model of a poem would support me in writing a poem.

8. I read poems during free time.

9. I read during my free time (choose from the alternatives: magazines/comics/novels/other books/internet articles)

Answer to the following statements according to whether you agree or disagree them.

(Scale in all statements: 1=completely disagree; 2=slightly disagree; 3=slightly agree; 4=completely agree)

10. I think that I can write poems.

Volume 22, Number 1: Spring 2021
ISSN: 1535-0975

11. I think I can write essays.

12. I think I can write stories.

13. I think that it is easy to start to write a poem.

14. I think I have good ideas in writing and composing a text.

15. It is easy to start to write a poem.

16. I can express myself by writing poems.

17. I think that it is fun to write poems.

18. I think it is more fun to write together than writing alone.

19. I think that a poem must have rhymes.

20. I think a poem must not be too long.

21. I think that it is nice to interpret poems.

22. I think that a poem must not be too easy.

23. Describe freely a poem by 1 - 3 adjectives.

Background questions

1. Gender

2. Age

3. The grade of Finnish language and literature in last school report

4. Estimate your interest for studying Finnish language and literature

5. Estimate your grade of computing skills by scale from 4 to 10

APPENDIX B: The Post-questionnaire for the Participants

(translated from Finnish to English)

Instruction: Answer to the following statements by selecting an alternative that best describes your opinions and experiences. (Scale in all statements: 1 = not at all; 2 = little; 3 = somewhat; 4 = much; 5 = a great deal)

1. The digital tool (the Poetry Machine) helped me in writing a poem.
2. A model of a poem supported me in writing a poem.
3. The possible to edit a poem (with the PM) supported me in writing.
4. The rhymer supported me in writing.
5. The possibility to get support from the Poetry Machine with the meter supported me in writing.
6. It was easy to start to write, because I got words ready from the Poetry Machine.
7. The Poetry Machine supported in choice of words.

Instruction: Answer to the following statements according to whether you agree or disagree. (Scale in all statements: 1=completely disagree; 2=slightly disagree; 3=slightly agree; 4=completely agree)

8. It was easy to start to write a poem with support of the Poetry Machine.
9. I was able to express myself by writing a poem with the support of the Poetry Machine.
10. The Poetry Machine supported to manage the writing of a poem.
11. I think that the poem was superior with the support the Poetry Machine.
12. Writing poems with the support of the Poetry Machine was funny.
13. How did the use of the Poetry Machine influence to your opinion of poetry?
14. Describe by own words your experience of writing with the support of the Poetry Machine.

Volume 22, Number 1: Spring 2021
ISSN: 1535-0975

Background questions

1. Gender

2. Age

3. The grade of Finnish language and literature in last school report

4. Estimate your interest for studying Finnish language and literature

5. Estimate your grade of computing skills by scale from 4 to 10

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Data Science Reveals US Higher Education and Student Loan Systems are Failing Students Who Need Them Most

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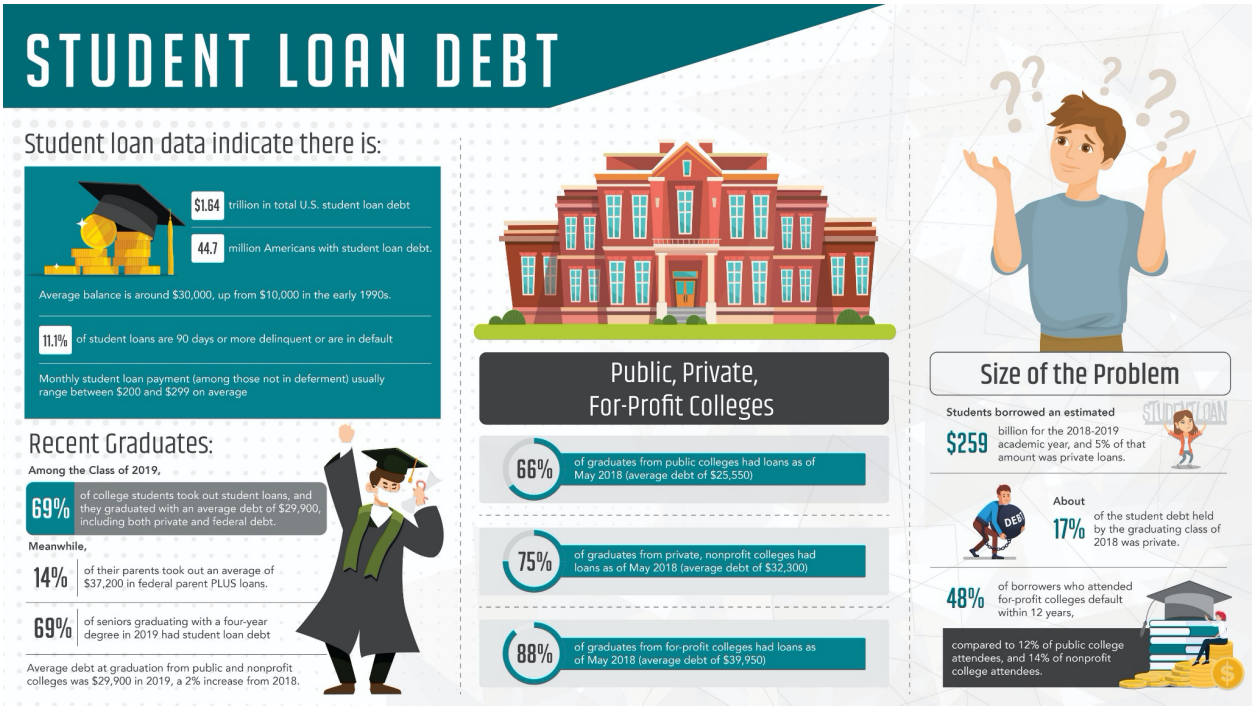
Word Cloud of the most common terms related to student debt,

sourced from 26 topical academic articles.

Introduction



Student debt in the US is an enormous problem. Almost 45 million Americans hold student debt, which totals an astronomical $1.64 trillion. With the 2020 Presidential election of Joe Biden, the important issue of student debt - and the potential for some type of student debt forgiveness - has once again risen to the foreground of social and political conversations.

In partnership with ShapingEdu, data scientists from social impact start-up Omdena examined the root causes and key parameters of the student debt problem in the US, and then built an innovative tool to empower potential borrowers with customized information on the financial and personal impacts of their student loans.

Working on a prompt by ShapingEdu, researchers from the social impact startup Omdena used social science and data science to examine the issue, producing key insights around the parameters, demographics, and causes of student debt. Then they prototyped a solution.

Omdena's data scientists found:

- The majority (76%) of student loan debt is under $40,000, with a large portion (35%) under $10,000. Defaults are driven not by large debt burdens, but by smaller loans, held by vulnerable populations who are not adequately equipped to pay off their loans.
- The system hurts those who need help the most - minorities and women. Minorities begin at a disadvantage, make (or are forced into) college choices that exacerbate that disadvantage, and then are faced with loan and repayment systems that are riddled with problems and difficult to escape.
- Private for-profit institutions are a particularly poor investment, with a poor cost-to-debt ratio, and low completion rates. They are a disproportionately large source of loan defaulters, many of whom are minority and low-income students.
- There is a strong correlation between student debt and mental health. Minority students are particularly vulnerable to for profit colleges, undue debt burdens, and stress from student debt. Women, Black and Hispanic graduates, and graduates from for profit universities, report the highest levels of stress from education debt.

Omdena's data scientists built on the insights gleaned from this project to develop an innovative solution - an application intended to empower students - especially the most vulnerable - with customized information on the financial and personal impacts of their student loans. Designed to go beyond traditional loan calculators, the app leverages historical data to create a personalized dashboard that guides students in decision making. Using a Loan Simulator and a Borrower Profile, the dashboard shows users the various repayment rates for "students like them" at different institutions. The app's tailored approach provides students with a potent interactive tool that demonstrates how decisions about loan types and colleges could affect them personally, helping borrowers avoid potentially damaging choices with long term ramifications.

What is the real student loan crisis?

WORD CLOUD based on searches for terms: “student debt crisis, student debt, student loan, and/or loan forgiveness” in Forbes.com 2013-2020 articles, Medium.com blog posts & Change.org petitions.

Student debt in the US is a multifold problem. The total debt itself is extremely high ($1.64 trillion) and is held by a significant number of people - almost 45 million Americans have student loan debt.[2] Omdena researchers used social science and data science to explore the parameters, causes and repercussions of the student debt crisis. Their findings are nuanced and unsurprising, supporting the significant body of research that points to the predatory practices of for-profit private colleges, and the systematic disadvantage faced by low-income students, female students, and students of color.

The total student loan debt in the US, and the number of debt holders, are rising rapidly due to multiple factors, including the increased importance and costs of a college degree, the increasing number of people attending college, and the accumulating costs of interest on the growing balance of loans. Omdena researchers focused on the ability of students to repay their loans as a central aspect of this problem. The cost of college and the amount of student loan debt across the nation would not be as much of an issue if graduates were earning enough to readily repay their loans. In other words - the investment value and potential payoff of the

[2] Friedman, Zack. "Student Loan Debt Statistics In 2020: A Record $1.6 Trillion." *Forbes. Forbes Magazine, February* 5 (2020). https://www.forbes.com/sites/zackfriedman/2020/02/03/student-loan-debt-statistics/?sh=44503e6281fe

college degree is as, if not more, important than the overall amount of debt and the number of borrowers.

Key Finding - The majority of the student debt burden consists of mid-sized and smaller loans. 76% of borrowers owe under $40,000, and a large portion (35%) owe under $10,000.

Omdena's research revealed that while the total student debt in the US is enormous, it is not primarily composed of huge loans, as one might assume.[3] Based on numbers from the US Department of Education, a surprising majority (almost 76%) of those holding student loans owe under $40K, and almost 35% owe less than $10K. So, in theory, repayment of a large portion of America's vast student loan debt should be relatively manageable. *See Figure 1.*

Figure 1 - Student Loan Balances by Number and Percentage of Borrowers
Source: Omdena Research and US Dept of Education

Student Loan Balance	Borrowers (millions)	Percentage of Borrowers
Less than $5000	8.3	18.3%
$5,000 - $10,000	7.5	16.5%
$10,000 - $20,000	9.2	20%
$20,000 - $40,000	9.5	21%
$40,000 - $60,000	4.1	9%

[3] Note - Recent articles that have shared this observation:
Friedman, Zack. "Student Loan Debt Statistics In 2020: A Record $1.6 Trillion." *Forbes. Forbes Magazine, February* 5 (2020). https://www.forbes.com/sites/zackfriedman/2020/02/03/student-loan-debt-statistics/?sh=44503e6281fe. Harris, Diane "The Truth About Student Debt: 7 Facts No One is Talking About" *Newsweek. August 8* (2019). https://www.newsweek.com/2019/08/23/student-debt-loans-truth-facts-cover-story-1453057.html.

$60,000 - $80,000	2.5	5.5%
$80,000 - $100,000	1.3	3%
$100,000 - $200,000	2.2	5%
Over $200,000	0.8	1.7%
TOTAL	45.4 million borrowers	100%

Key Finding - Most borrowers are able to repay their loans. However, for 30% of Federal Direct Loan holders, student debt has proven unmanageable, indicating that their college education was not worth the investment.

The overall manageability of student loan debt is supported by the fact that most of the Federal Direct Loan debt - which represents a majority of the total student loan debt ($1.2 trillion of the $1.6 trillion, held by 39 million of the total 45 million borrowers) is in good standing. Based on numbers from the Department of Education, 70% of the Direct Loan debt, held by 70% of borrowers, is either in Repayment, or held by borrowers who are still in school or in a grace period after graduation.

The “problem” group is the remaining 30% - $370 billion in Direct Loans, held by almost 12 million people - which are either in Default, Deferment or Forbearance. For this group student loan debt has proved to be an unmanageable burden - their education was not worth the investment and did not empower them with the resources to repay their debts.

Roughly half of this group is comprised of the 6.4 million Americans (16% of all borrowers) who have needed to put their loans in Deferment or Forbearance, representing $250 billion dollars, or 20% of the total borrowed amount. The other half of this group consists of the

5.5 million Americans (14% of all borrowers) who have defaulted on almost $120 billion dollars in loans - 10% of the total borrowed amount. *See Figure 2.*

Figure 2 - Direct Loans - Status by Borrowers and Loan Amount
Source: Omdena Research and US Dept of Education

STATUS	NUMBER of Borrowers (in millions)	PERCENT of Total Borrowers	LOAN AMOUNT (in Billions)	PERCENT of Total Loan
In Repayment	18.5	47%	$ 685.5	55.5%
Still in School	7	18%	$ 131.5	11%
Deferment or Forbearance	6.4	16%	$ 251.3	20%
Default	5.5	14%	$ 119.8	10%
Grace Period	1.8	5%	$ 45.2	3.5%
ALL Direct Loans	39.2 million	100%	1,233.3 Billion USD	100%

As a June 2019 report by The Institute for College Access & Success (TICAS) explains, "default is the most devastating possible student loan outcome. Upon entering default, the entire unpaid balance (including accumulated interest) becomes due."[4] Default destroys a borrower's

[4] Ahlam, Lindsay and Gonzalez, Veronica "Casualties of College Debt: What Data Show and Experts Say About Who Defaults and Why" The Institute for College Access & Success (TICAS). June 2019. https://ticas.org/wp-content/uploads/2019/09/casualities-of-college-debt.pdf

credit score, makes repayment extremely difficult, and can create compounding financial hardship. To collect unpaid debt, the federal government can garnish a defaulted borrower's wages, as well as withhold tax refunds and other federal benefit payments. Defaults negatively impact more than the lives of defaulters themselves; they also affect the interest rates for all borrowers. Working to address the causes of defaults and prevent them should be a key element of any manageable and equitable educational system.

Key Finding - Defaults are driven by smaller loans (under $10,000) - and vulnerable populations.

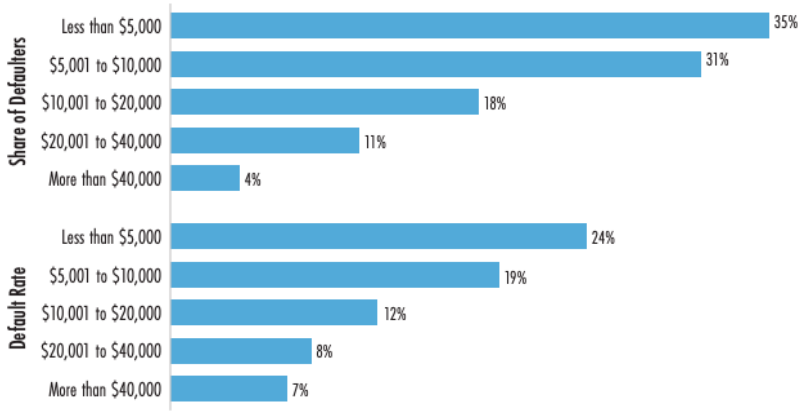
Who are those students who are most likely to default on their loans, and why? Omdena's research echoes work by groups such Utah State University's Center for Growth and Opportunity, The Institute for College Access & Success (TICAS), New America, and the Center for American Progress, which has found that "the nation's current system of higher education puts the most vulnerable students at the greatest risk of default."[5]

Research by Utah State University's Center for Growth and Opportunity, for instance, found that default is most common among borrowers with smaller balances.[6] As the figure below shows, nearly two-thirds of defaulters have less than $10,000 in student debt. In fact, the default rate for borrowers with less than $5,000 in debt is more than three times that of borrowers with over $40,000 in debt. *See Figure 3.*

Figure 3 - Default Rate by Loan Balance
Source: Omdena Research and Center for Growth and Opportunity

[5] Miller, Ben. "Who Are Student Loan Defaulters?" Center for American Progress. December 14, 2017. https://www.americanprogress.org/issues/education-postsecondary/reports/2017/12/14/444011/student-loan-defaulters/

6 Hedlund, Aaron. "What Can Be Done to Address Rising Student Debt?." The Center for Growth and Opportunity, Utah State University. (2019). https://faculty.missouri.edu/~hedlunda/policy/CGO_studentdebt.pdf



New America's 2019 exploration of debt among Millennials revealed that four groups of borrowers are experiencing particularly acute financial hardship: students of color, low-income students, those who do not graduate, and those attending for-profit institutions. These groups of borrowers often overlap, leading to high rates of default. Low-income students and students of color have higher rates of borrowing, but lower rates of graduation - leading to the double whammy of debt without the associated wage gains of a college degree. These students are over-represented in for-profit private colleges, whose poor student outcomes make student debt even more difficult to manage.[7] A Center for American Progress review of data related to loan defaulters from the National Center for Education Statistics (NCES) similarly found that borrowers who default on their loans are more likely to be first generation, non-completers, financially independent (without parent support), low income, and enrolled in private for-profit colleges.[8] *See Figure 4.*

[7] Whistle, W. "Millennials and student loans: Rising debts and disparities." in "The Emerging Millennial Wealth Gap Report" New America. October 29, 2019 https://www.newamerica.org/millennials/reports/emerging-millennial-wealth-gap/millennials-and-student-loans-rising-debts-and-disparities/

[8] Miller, Ben. "Who Are Student Loan Defaulters?" Center for American Progress. December 14, 2017. https://www.americanprogress.org/issues/education-postsecondary/reports/2017/12/14/444011/student-loan-defaulters/

Figure 4 - Borrowers and Defaulters, Demographics
Source: Center for American Progress

TABLE 1

Share of borrowers, by demographics and default status

Students entering college in 2003-04 who took out a federal loan within 12 years of entry

	Percent of defaulters	Percent of all borrowers	Percentage-point difference
Age			
18 or under	35	47	-12
20 to 29	33	21	12
Attainment			
Bachelor's degree	10	34	-25
Dropout	49	30	19
Dependency			
Dependent			
Independent with dependents			
Parent education level			
No college degree	70	54	15
Finances			
$0 expected family contribution	43	25	18
Bottom 25%	40	27	14
Top 25%	10	20	-10
Borrowed for graduate school	5	18	-13
Pell			
Ever received Pell Grant	87	68	19
Race			
White	44	60	-16
Black or African American	30	17	13
Hispanic or Latino	18	14	4
Parent education level			
Public four-year	19	29	-11
Private nonprofit four-year	11	17	-6
Public two-year	31	33	-2
Private for-profit	38	19	18

Source: Author's analysis of data from National Center for Education Statistics, "2003-04 Beginning Postsecondary Students Longitudinal Study, Second Follow-up (BPS:04/09)," Tables cdmbhp15, cdmbhm7a, cdmbhnf95, benbhb2a, cdmbhnkde8, cdmbhn6c, cdmbhpbff, cdmbhnf34, cdmbhm72, and cdmbhmb52, available at https://nces.ed.gov/datalab/powerstats/default.aspx (last accessed November 2017).

CAP

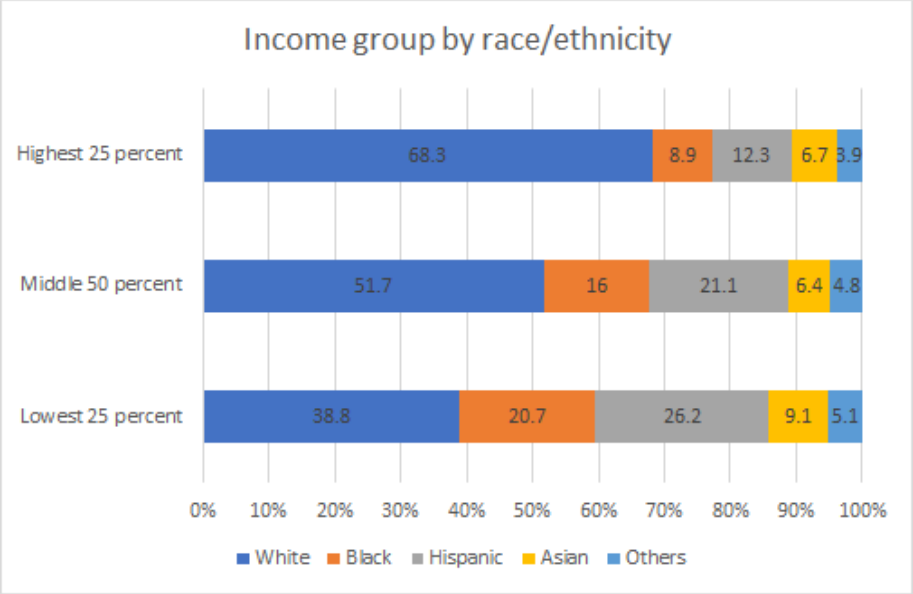
Who is most affected?

Key Finding - The education and loan pipeline - from choosing schools to taking out and repaying loans - has a disproportionately negative effect on minorities and low-income borrowers.

Omdena's review of data from the National Center for Education Statistics (NCES), the United States Department of Education's College Scorecard, the Bureau of Labor Statistics, and the Institute for Women's Policy Research ultimately found that the entire education and loan pipeline - from choosing schools to taking out and repaying loans - has a disproportionately negative effect on minorities and low-income borrowers.

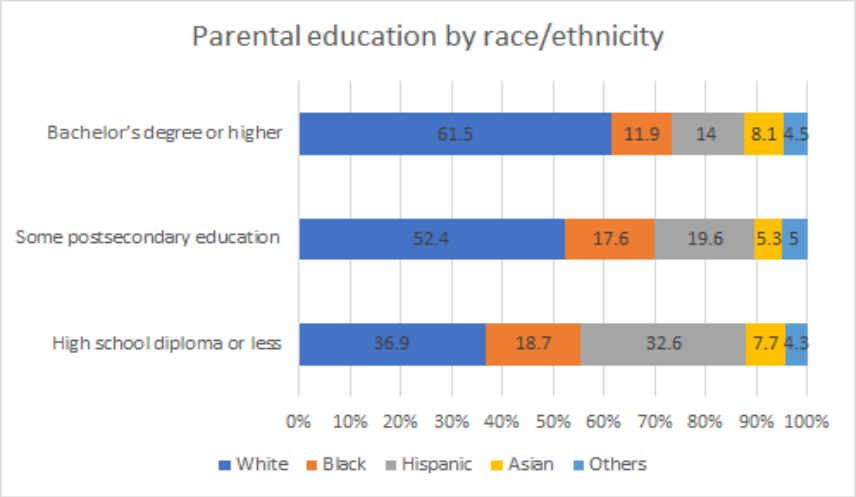
Key Finding - Minority students are at a disadvantage from the onset. First of all, minority students are more likely to be low income. ***See Figure 5.***

Figure 5 - Income group by race/ethnicity
Source: Omdena research and National Center for Education Statistics



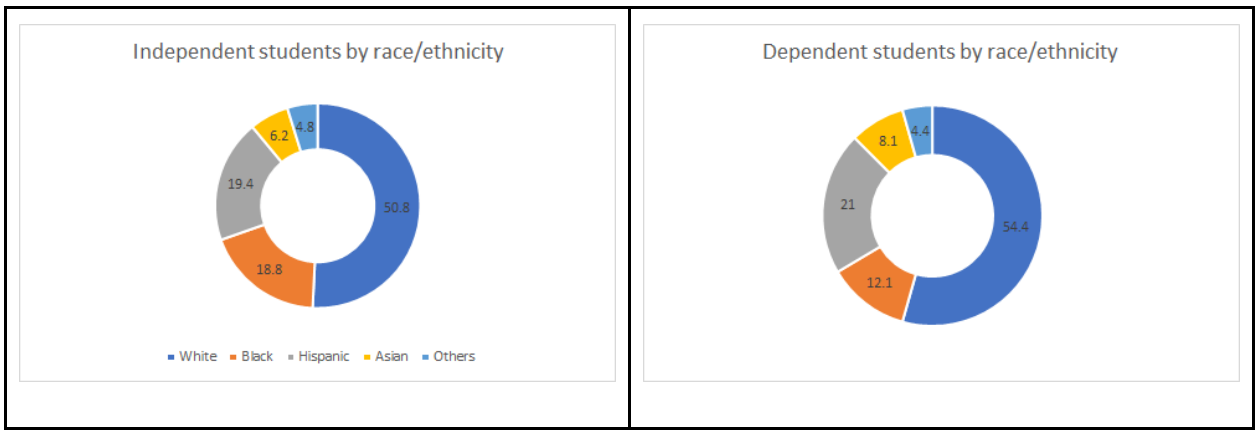
In addition, first generation students (those whose parents didn't go to college) are most likely to be Hispanic and Black. *See Figure 6.*

Figure 6 - Parental Education by Race/Ethnicity
Source: Omdena research and National Center for Education Statistics



And finally, Black students are also 50% more likely to be independent - that is, without parent financial support. *See Figure 7.*

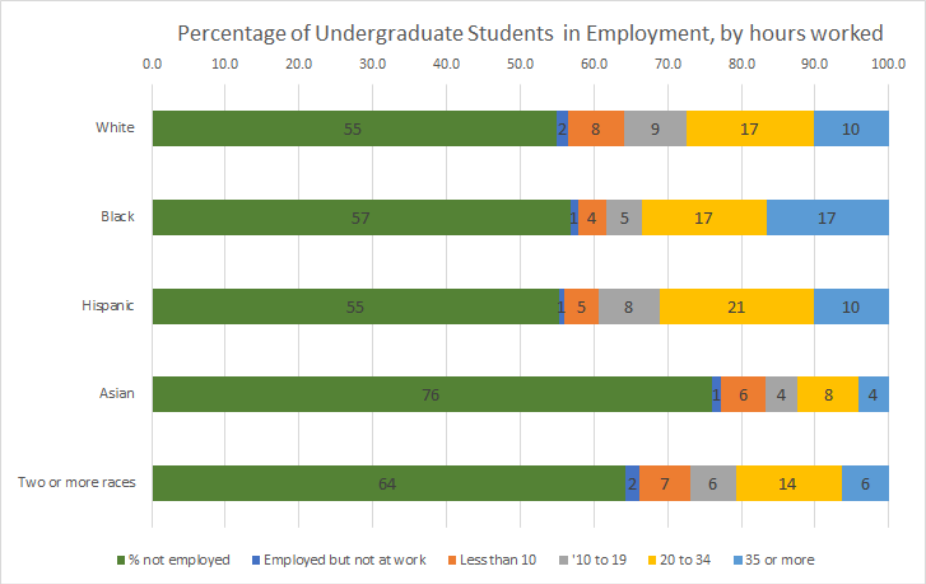
Figure 7 - Student Status (Independent/Dependent) by Race/Ethnicity
Source: Omdena research and National Center for Education Statistics



Many students - including over a third of all White, Black, and Hispanic students - are working at least 10 hours/week while in school. Asian students in particular are most able to focus on schoolwork without having to balance it with outside jobs. Black and Hispanic students

are most likely to be working at least 20 hours/week, and often over 35 hours/week - leaving little time for schoolwork. *See Figure 8.*

Figure 8 - Undergraduate Students - Hours Worked
Source: Omdena research and National Center for Education Statistics



The trouble with for-profit colleges

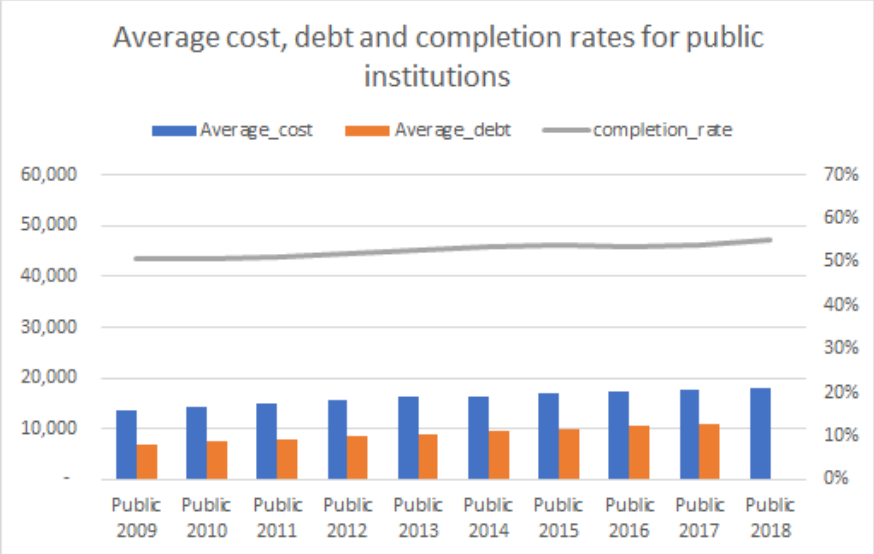
Key Finding - Private for-profit colleges are a particularly bad investment. Their high rates of debt, low completion rates, and lack of payoff lead to frequent defaults.

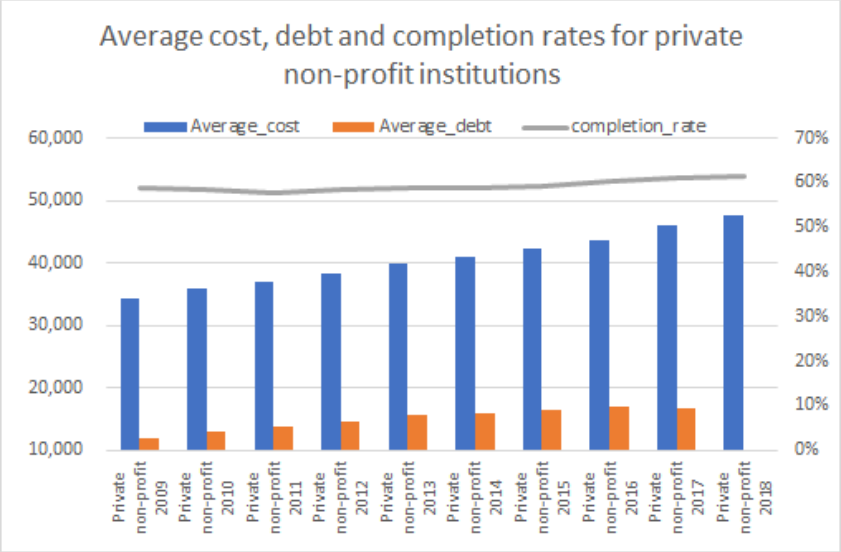
Using College Scorecard data from 2009-2018, Omdena researchers compared the costs, debt burden and completion rates of public institutions, private nonprofit colleges, and private for-profit colleges. Private for-profit colleges proved to be the worst investment - with lowest completion rates, and a poor cost-to-debt ratio.

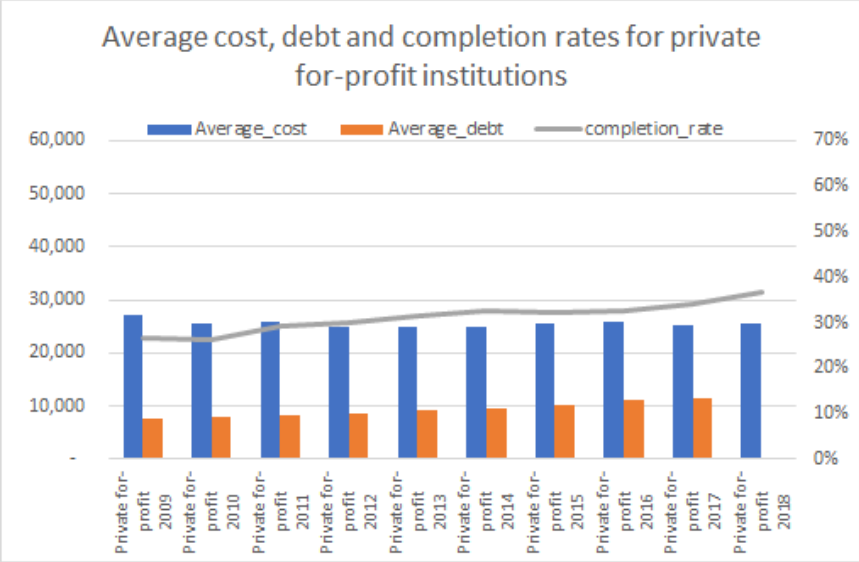
Completion rates in particular are an important factor - as students who do not complete college are saddled with debt, without the benefits of added income from their degree. So, for instance, while completion rates at public universities and at private nonprofit universities hover around 60%, completion rates at private for-profit universities are consistently under 30%.

Private non-profit schools are by far the most expensive, costing over twice as much as public schools - with a price tag that has increased by almost $15,000 in the past ten years, while the costs of the other schools have remained relatively steady. However, private nonprofit schools offer more support for students, and are attended by students who are better equipped to pay, so that the average debt at private non-profit schools, while higher, makes up a much smaller portion of the overall fees. For instance, in 2017, the average cost of a private nonprofit school was $48,000 per year, with an average debt of around $17,000 per year - roughly 35% of the cost. In comparison, at private for-profit colleges the average debt of $12,000 per year is roughly 50% of the $25,000 annual tuition. *See Figure 9.*

Figure 9 - Average cost, debt and completion rates - by type of Institution
Source: Omdena research and US Department of Education



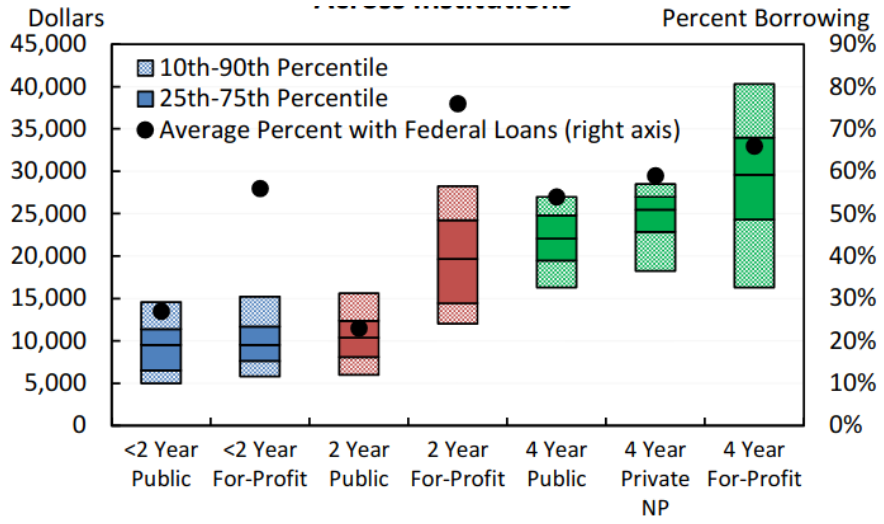




Omdena's analysis of student debt held while students are still in school found that students attending for profit schools are most likely to have student debt - almost 80% of all students in 2 year for profits and 70% of students in 4 year for profit colleges have taken loans. At the other end of the spectrum are students attending 2-year public colleges, where only about 20% of students have student loans. See Figure 10.

Figure 10 - Student Borrowing by Institution
Sources: Omdena research and US Department of Education College Scorecard, US

Department of Education Federal student loans dataset and Federal Reserve Bank of New York student loan and demographics dataset.



Upon graduation, the student debt burden is even heavier. According to 2018 data, private for-profit colleges have the highest percentage of graduates with student loans (88%), with the highest average debt - almost $40,000. Private nonprofit colleges are next in line (75% of graduates have loans, with an average debt of $32,300). In comparison, “only” 66% of graduates from public colleges had loans, and at $25,550, their average debt is much lower.

The high rates of debt, the low completion rates, and the lack of payoff, lead to high rates of default for student borrowers from for profit colleges. A 2019 analysis by the Chicago Booth Review found that while for-profit colleges only enroll 10 percent of US students, they account for up to 25% of all borrowing, and approximately half of student-loan defaults.[9] Similarly, a 2018 report by TICAS found that 48% of borrowers who attended for-profit colleges default within 12 years, compared to 14% of nonprofit private college attendees and 12% of public college attendees.[10]

[9] Gold, Howard. “Who’s at fault for student-loan defaults?” Chicago Booth Review, May 13, 2019. https://review.chicagobooth.edu/public-policy/2019/article/who-s-fault-student-loan-defaults
[10] The Institute for College Access & Success (TICAS). “Students at Greatest Risk of Loan Default” April, 2018

Graduates from these programs agree with this negative assessment. Omdena's analysis of a 2012 NCES Survey of 2007-8 Bachelor's degree recipients found that just 54% of respondent from private for-profit colleges reported that their degree was worth the financial costs - compared to 72% of overall respondents. See Figure 11.

Figure 11 - Student Borrowing by Institution
Source: Omdena research and 2012 NCES Survey "B&B"

Borrowing, employment, enrollment, and demographic characteristics	Percentage of respondents who reported that their degree was worth the financial cost
All Respondents	72.2
Did not borrow	81.5
Borrowed	68.5
Attended Public University	75.1
Attended Private Nonprofit University	69.1
Attended Private For-profit University	54.2
Sex - Male	71.6
Sex - Female	72.7
Race -White	72.8
Race -Black	68
Race - Hispanic	71.6
Major - Computer and information sciences	75.1
Major - Engineering and engineering technology	85.2
Major - Biological and physical sciences, science technology, mathematics, and agricultural sciences	75.1

https://ticas.org/wp-content/uploads/legacy-files/pub_files/students_at_the_greatest_risk_of_default.pdf

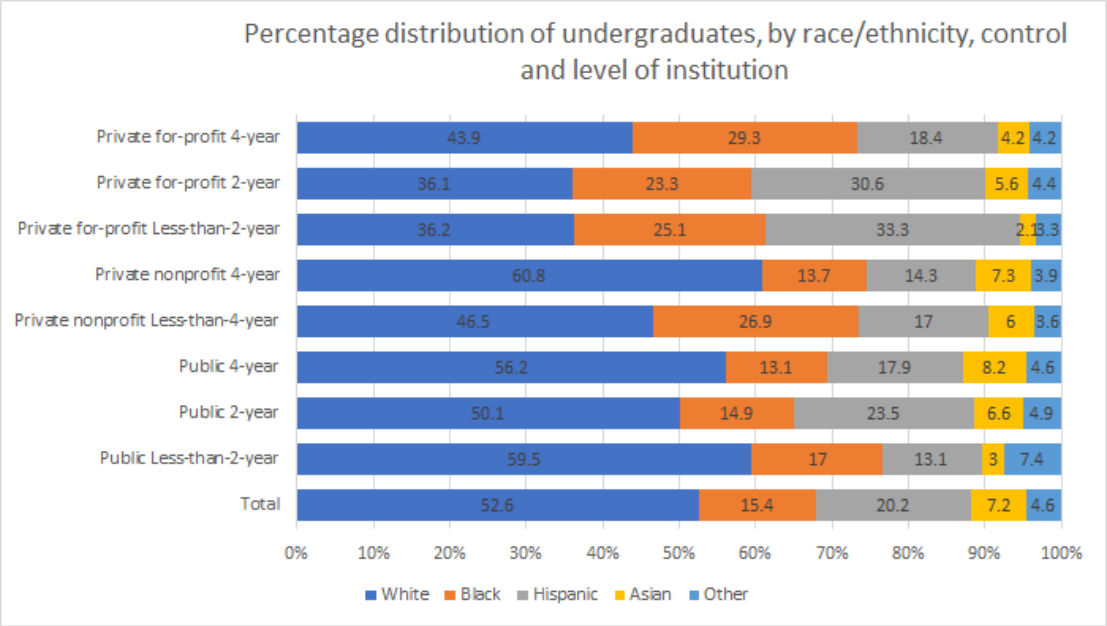
Major - General studies and other	76.4
Major - Social sciences	70.3
Major - Humanities	64.2
Major - Healthcare fields	76.1
Major - Business	73.5
Major - Education	77
Major - Other applied	65.8

Key Finding - Minority students are particularly vulnerable to for profit colleges, and face undue debt burdens

Omdena researchers also analyzed the data surrounding student school choices and graduation rates. They found that minority students are making - or being forced into - poor school choices, with negative impacts on future career prospects, earning potential, and the ability to repay loans.

NCES data from 2015-16 shows that Black and Hispanic students are overrepresented in private, for profit colleges - especially in those offering 2 year and under degrees. White and Asian students primarily attend nonprofit or public 4-year schools, which offer a better investment. Interestingly, both White and Black students are overrepresented in public less than 2-year schools. *See Figure 12.*

Figure 12 - Undergraduate Students by Race and Type of Institution
Source: Omdena research and NCES



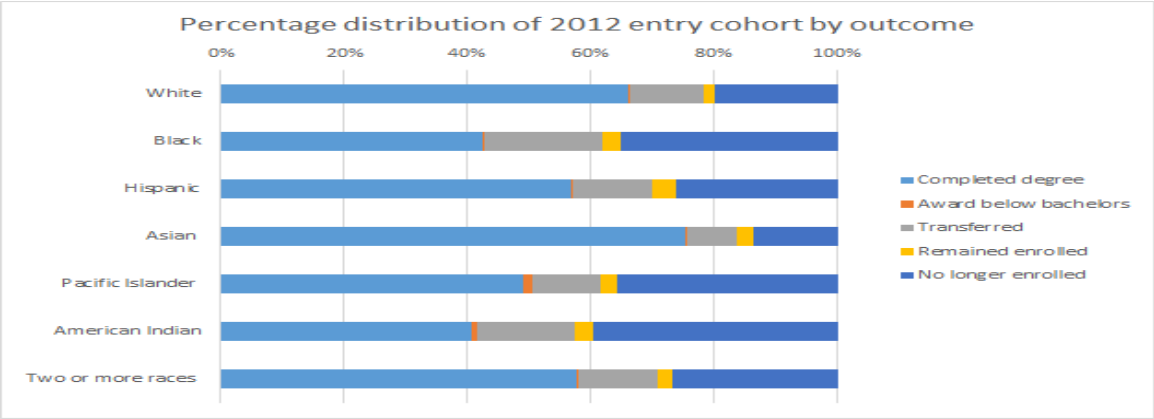
These findings are supported by College Scorecard data from 2013-14, which shows that private, for-profit schools have the highest share of female, minority, and first-generation students - while private non-profit schools have the lowest share. *See Figure 13.*

Figure 13 - Undergraduate Students by Race and Type of Institution
Source: Omdena research and College Scorecard 2013-2014

Type of Institution	% Black	% Hispanic	% Female	% 1st Gen
Public	14%	13%	58%	46%
Private non-profit	13%	12%	59%	36%
Private for-profit	24%	19%	70%	52%

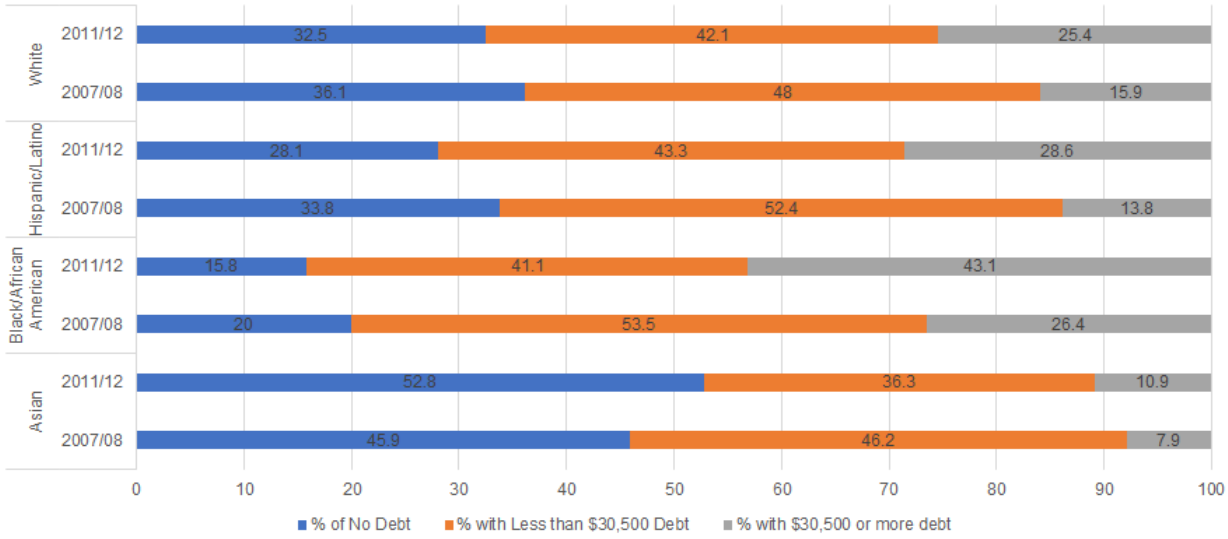
In addition, according to NCES Data from 2018, dropout rates at 4-year colleges are highest for American Indian, Black, and Pacific Islander students. *See Figure 14.*

Figure 14 - Degree Completion by Race
Source: Omdena research and NCES Digest Table 326.15



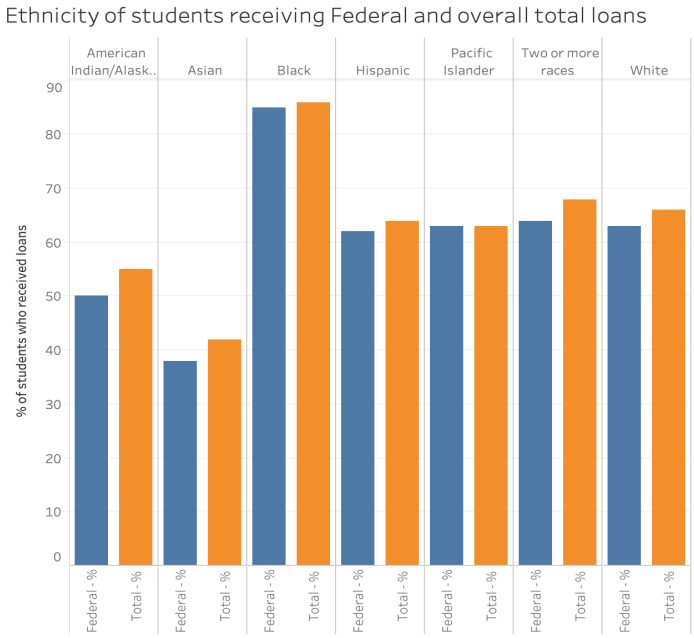
As a consequence of the factors above, Omdena research found, minority college students are more likely to be in debt, with higher levels of debt. Omdena's review of NCES's National Postsecondary Student Aid Study (NPSAS) data from 2007 and 2011 on the distribution of student loan debt across Bachelor's degree recipients demonstrates that Black and Hispanic students are more likely to be in debt and have higher levels of debt. This chart also shows how, between 2007 and 2011, debt increased across the board for all groups - White, Black and Hispanic - except for Asian students. The size of the debt burden also went up for all groups, including Asian students. In other words, for all groups, the percentage of borrowers with loans over $35,000 increased between 2007 and 2011. That increase was greatest (17%) for Black students, and lowest (3%) for Asian students. See Figure 15.

Figure 15 - Student Loan Debt by Race
Source: Omdena research and NCES National PostSecondary Student Aid Study (NPSAS)



In addition, Omdena's analysis of 2015-2016 NCES data on student borrowers ages 18 to 24 in their 4th (senior) year or above shows that Black students also have by far the highest percentage of loans. *See Figure 16.*

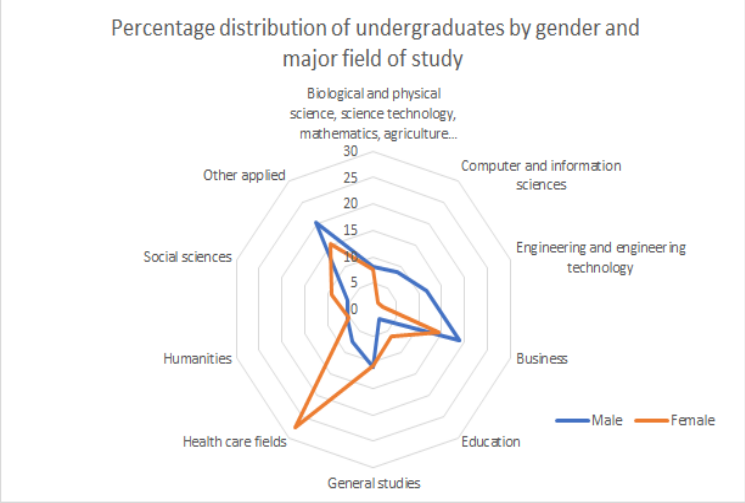
Figure 16 - Student Borrowers by Race
Source: Omdena research and NCES



Key Finding - Gender differences are most apparent in choices of major and career. The Gender wage gap increases with education.

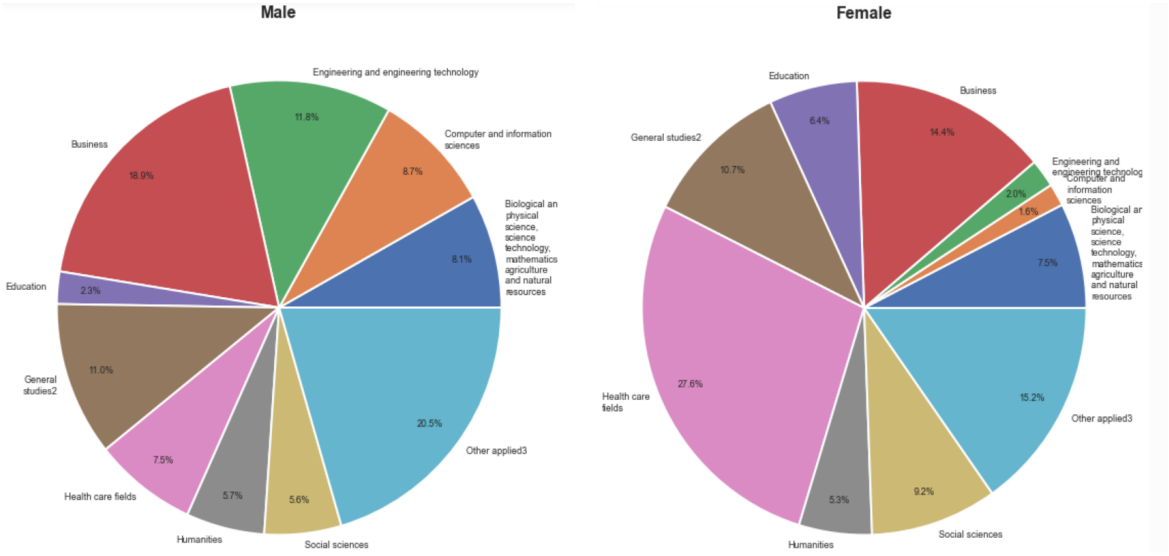
Omdena researchers also found that gender differences were most apparent in field of study and career choices. Women far outnumber men in the fields of healthcare, humanities, and, to a lesser degree, education. Men most outnumber women in STEM fields. Business and applied sciences are favored by both genders, with more men than women in both cases. *See Figure 17.*

Figure 17 - Undergraduate Students by Gender and Field of Study
Source: Omdena research and NCES



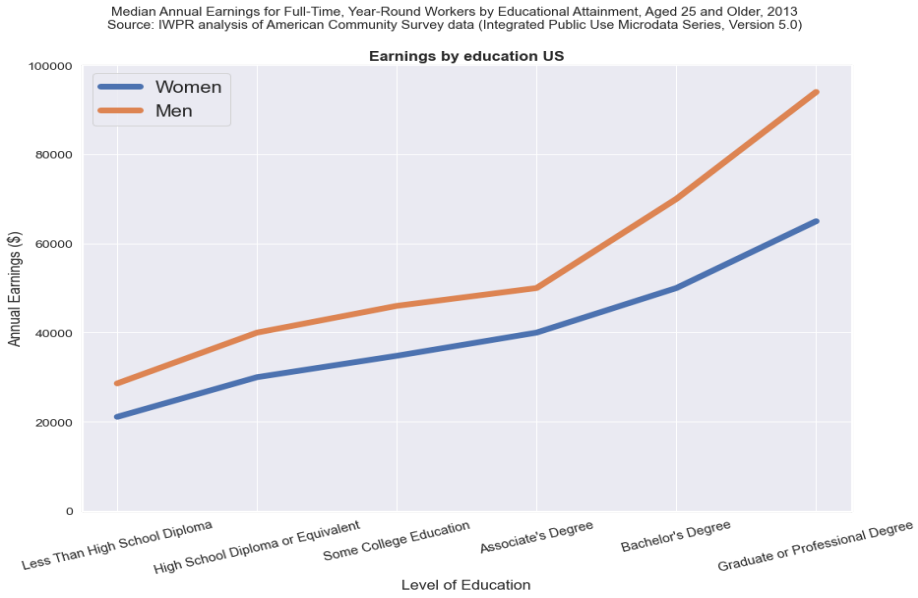
In terms of career choices, both genders show a preference for business and applied sciences. However, there are far more men in both fields, and women's top choice, by far, is healthcare. *See Figure 18.*

Figure 18 - Education Fields by Gender
Source: Omdena research and NCES



Astonishingly, the gender wage gap increases with education. Data curated by the Institute for Women's Policy Research indicates that while the wage gap between men and women with up to an Associate's degree was roughly $10,000 annually in 2013, that gap increased to $20,000 for college graduates, and $30,000 for those with advanced degrees. In fact, women with advanced degrees made less than men with Bachelor's degrees. See *Figure 19*.

Figure 19 - Earnings by Gender and Level of Education
Source: Omdena research and Institute for Women's Policy Research "Status of Women in the States" Project, 2013



The true costs of student debt

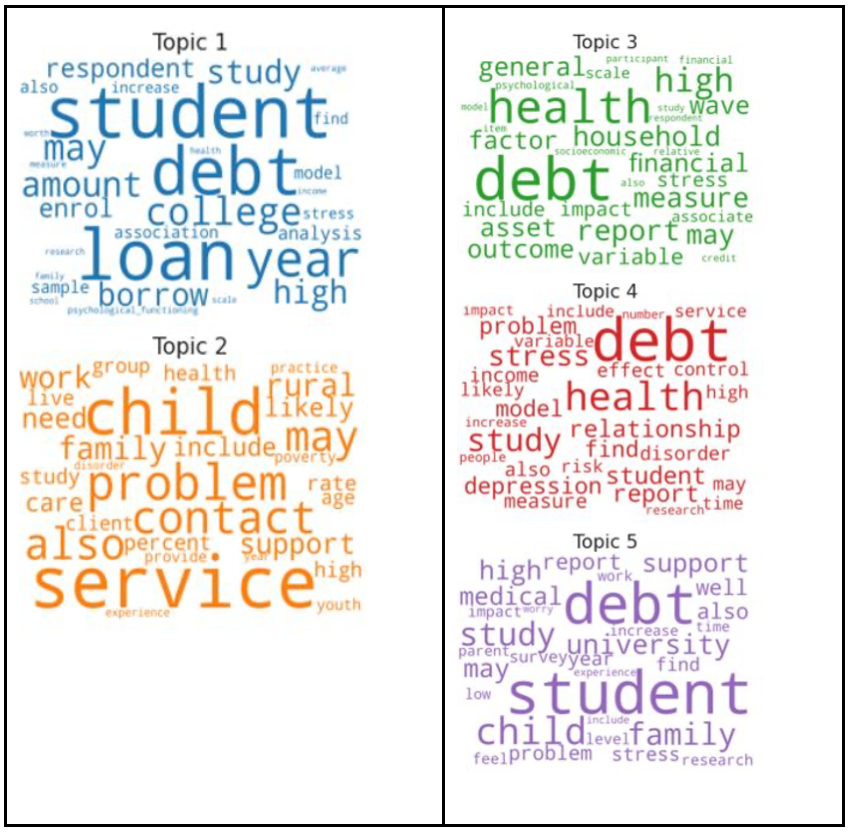
Key Finding - There is strong correlation between student debt and mental health

Omdena's textual analysis of academic papers related to student debt and mental health found a strong correlation between these key terms. The Word Cloud below, created from the 20 most frequently used terms found in a review of 26 topical academic articles, visualizes the four largest terms- debt, student, health and mental. *See Figure 20.*

Figure 20 - Word Cloud - 20 Most Frequent Terms related to Student Debt & Mental Health

Omdena researchers used topic modeling, which clusters key words together, to create the top five topic clusters illustrated below. These reveal a relationship between debt & mental health (Topics 3 and 4) and student debt and family (Topics 2 & 5). *See Figure 21*

Figure 21 - Top Five Topics related to Student Debt & Mental Health



Key Finding - Women, Black and Hispanic graduates, and graduates from for-profit universities, report the highest levels of stress from education debt

Omdena's analysis of self-reported data on education debt related stress, from NCES's Baccalaureate and Beyond Longitudinal Study (specifically, the 2012 Survey of 2007–08 Bachelor's degree recipients), found that graduates from private for-profit universities reported the highest levels of stress. 56% of graduates from these universities reported either high or very high levels of stress - as opposed to 40.6% of graduates overall. Women, Black and

Hispanic graduates, in particular, reported significantly above average amounts of “very high” levels of stress. *See Figure 22.*

Figure 22 - Undergraduate Students by Race and Type of Institution
Source: Omdena research and NCES Baccalaureate and Beyond Longitudinal Study

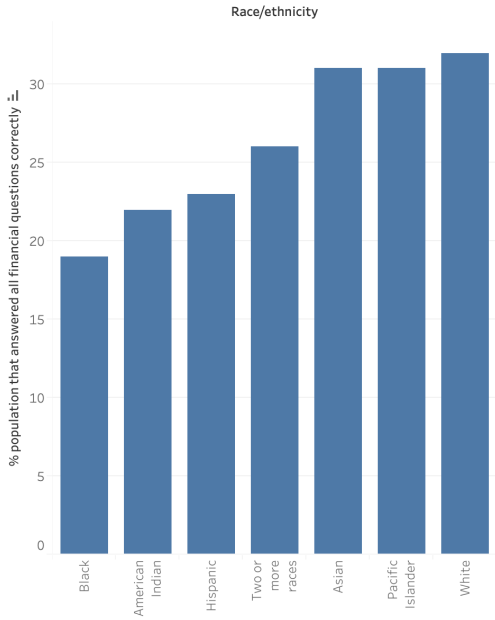
Borrowing, employment, enrollment, and demographic characteristics	Level of stress reported from education-related debt				
	Very low	Low	Moderate	High	Very high
All Respondents	9.4	18	32	21.6	19
Attended Public University	11.3	19.2	32.5	19.3	17.7
Attended Private Nonprofit University	7.1	17.4	31.3	23.3	20.9
Attended Private For-profit University	3.1	10	30.8	34.7	21.3
Sex - Male	13.1	22	30.9	20.5	13.6
Sex -Female	6.8	15.3	32.8	22.3	22.8
Race -White	10.3	19.1	31.9	21.3	17.4
Race - Black	5.7	15.3	29.6	21.3	28.1
Race - Hispanic	7.8	12.9	32.7	23.5	23.1

Omdena Solution - Web Application

One key driver of poor outcomes is the fact that financial literacy is low for all students. According to NCES data on the percentage of undergraduates responding correctly to financial literacy questions, no students - regardless of age or race - were able to score over 40%.

Asians, Pacific Islanders and White students scored best (just over 30%), while Black students scored worst (under 20%). *See Figure 23*.

Figure 23 - Undergraduate Student Financial Literacy by Race
Source: Omdena research and NCES Profile of Undergraduate Students 2015-2016



In addition, the loan repayment system itself is riddled with problems. These include inconsistent, confusing and predatory lending practices, a lack of incentive for loan servicers to be helpful, the reduction in state support for public institutions, and a lack of understanding by borrowers. A range of solutions to the student debt crisis have been offered - by politicians, as well as policy organizations. Sample solutions include simplifying the system, instituting an income-based program for all, strengthening oversight of the loan program and its servicers, improving borrower education, and many more.[11]

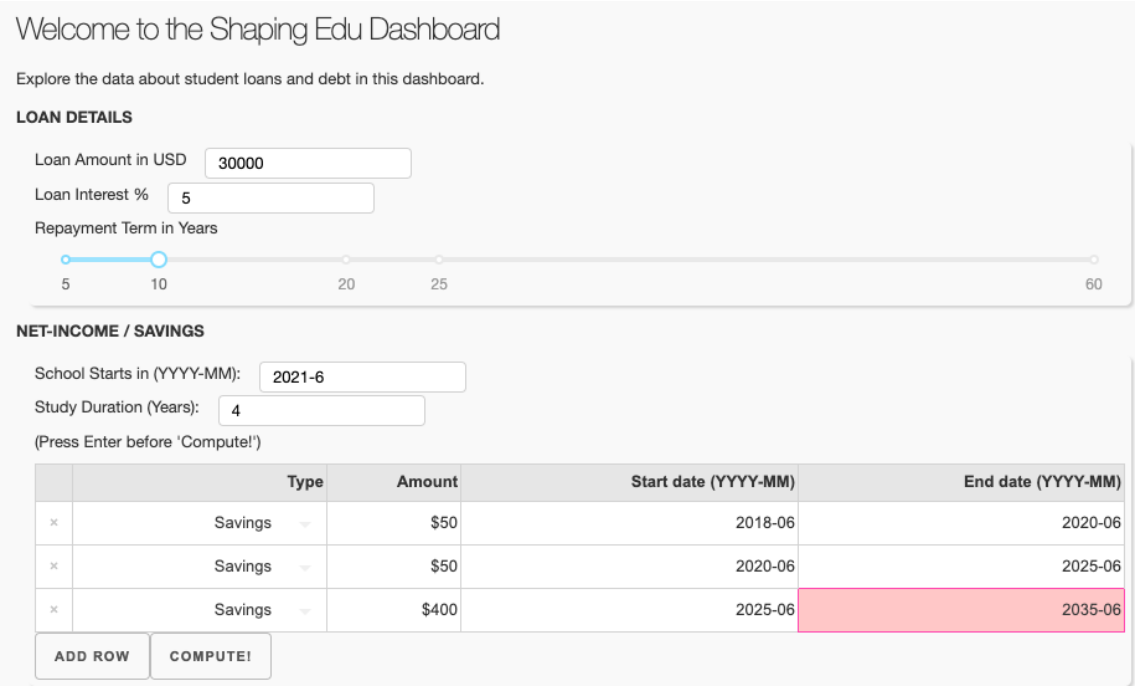
[11] Sample reports, policy papers and articles outlining solutions include:
Johnson, Daniel. "What Will It Take to Solve the Student Loan Crisis?" Harvard Business Review. 2019. https://hbr.org/2019/09/what-will-it-take-to-solve-the-student-loan-crisis
Campbell, Colleen. "How Congress Can Fix Student Loan Repayment." Center for American Progress. 2019. https://vtechworks.lib.vt.edu/bitstream/handle/10919/89155/HowCongressCanFixServicing.pdf?sequence=1&isAllowed=y

A team of collaborators on Omdena's Student Debt challenge took a slightly different approach. Their intent was to arm students with targeted financial and personal insights into the impacts of their student loans. Towards that end, challenge participants developed a Web app prototype, available here, intended to guide students in decision making by offering two different types of visualizations - a Loan Simulator, and a Borrower Profile. Based on background and loan info, the app's dashboard graphs the repayment burden over time for different loan types. The dashboard also leverages student demographic information to illustrate repayment rates for "students like them" at different institutions. This second visualization is particularly powerful, guiding their choices by enabling users to see how students of similar backgrounds have fared at different institutions.

For the Loan Simulator portion, users of the app input loan details - the size of the loan, the interest rate, and the length of the repayment term. They also indicate the year that their education begins, and the estimated duration of study. Finally, they estimate their savings ability, with options for up to three different life stages (such as before, during and after college).

The example below shows a loan amount of $30,000, at an interest of 5%, to be paid off over the course of 10 years. It assumes a school start date of June 2021, for a duration of 4 years - for graduation in June of 2025. In the example below, the borrower posits that they would be able to save $50/month for 2 years before the start of school, as well as $50/month during the four years they are in school. They also estimate a savings ability of $400/month after graduation. *See Figure 24.*

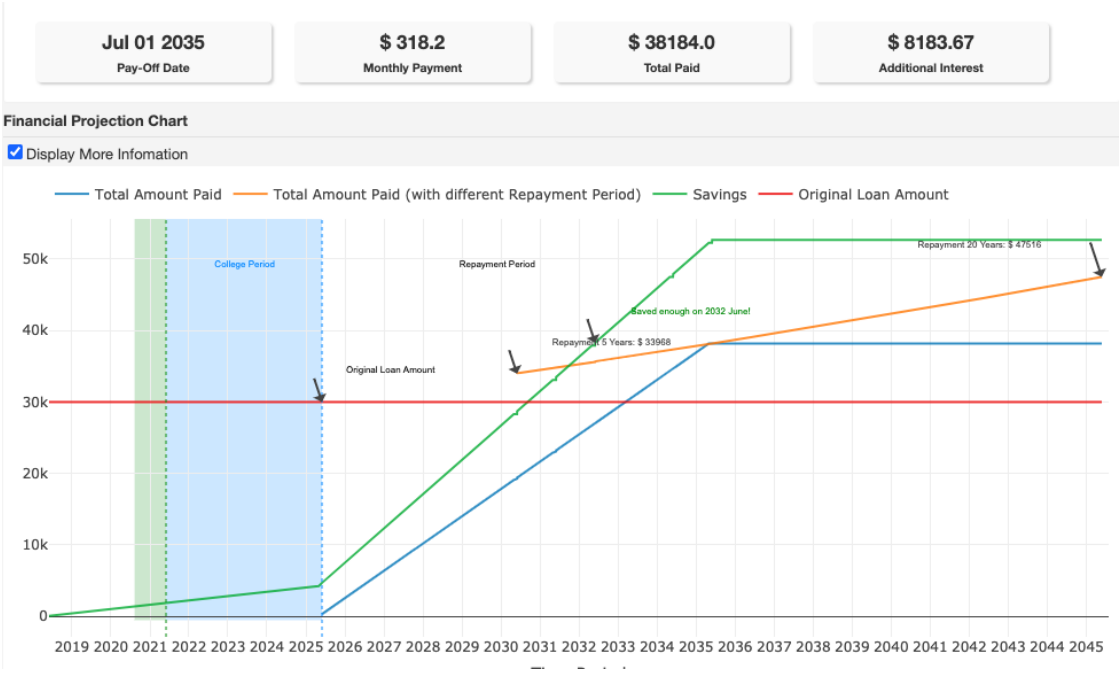
Figure 24 - ShapingEdu Dashboard
Source: Omdena



Based on this information, the Omdena ShapingEdu Dashboard shows the estimated monthly payment, the payoff date, the amount of interest that will be paid, and the total amount paid at payoff. For our example, the monthly payment is estimated at around $318, with a payoff date of July 1, 2035. Total interest over these ten years will be almost $8,184, so that the total amount paid will be $38,184.

A line chart on the dashboard provides a visual demonstration of these numbers. A red line indicates the original borrowed amount. The blue line shows repayment beginning upon graduation in 2025, and ending in 2035, when the loan has been paid off, with interest. A yellow line shows the payoff point and total amounts if the loan were taken for a shorter amount of time (5 years) or a longer amount of time (20 years.) And finally, a green line tracks the amounts saved - indicating when the borrower has saved enough to pay off the loan in full - in our case, by June 2032. *See Figure 25.*

Figure 25 - ShapingEdu Dashboard
Source: Omdena



Adjusting the inputs - loan amount, interest rate, terms, study duration and savings amounts - produces different results and visualizations. While other student loan calculators provide similar information, the prototype developed by Omdena creates an interactive graphic that helps borrowers immediately visualize and better understand the implications of their loan terms. In particular, it brings home the impact of interest rates, and repayment times.

The Borrower Profile section leverages historical data from College Scorecard to enable users to see how borrowers like them fare in repayment at their institution of choice. Borrowers input profile information such as the name of the school, their gender, family income, and whether they are an independent student (paying their own way) or dependent. They also indicate whether they are a first-generation student, and if they have graduated.

The app provides borrowers with a series of repayment statistics for borrowers with similar personal profiles after 3, 5 or 7 years. Borrowers could see, for instance, the difference graduating or not graduating makes on repayment statistics. They can see how well first-generation borrowers, or female borrowers, or borrowers with a similar income level, fare in

student loan repayment at their school of choice. User profiles are a powerful tool for future planning and enable borrowers to leverage real world data on “students like them” to make important decisions regarding school choice and student debt in an informed manner.

Conclusion

In partnership with ShapingEdu, Omdena’s data scientists examined the root causes and key parameters of the student debt problem in the US, and then built an innovative tool to empower potential borrowers with customized information on the financial and personal impacts of their student loans.

Omdena’s researchers found that student debt is often a result of poorly informed choices by borrowers who don’t adequately understand the implications of their school costs and are not equipped to evaluate the value of their educational investments. These students often make (or are forced into) college choices that exacerbate existing economic disadvantages, trapping borrowers in cycles of debt that are difficult to escape.

The prototype designed by Omdena researchers combines user provided demographic information and existing student loan data to generate personalized financial predictions for users. The Loan Simulator enables borrowers to see into the future - visualizing monthly payments, interest rates and payoff amounts for different size loans. The Borrower Profile provides even more powerful insights, enabling borrowers to see what repayment rates look like for borrowers “like them” at different schools. These two interfaces help guide student choices, empowering students with essential information to help make informed decisions regarding schools and student loans. As the US addresses the important issue of crippling student debt, helping borrowers make informed decisions about educational investment will be essential to preventing future burdens and promoting a thriving economy.

References

Ahlam, Lindsay and Gonzalez, Veronica “Casualties of College Debt: What Data Show and Experts Say About Who Defaults and Why” The Institute for College Access & Success (TICAS). June 2019. https://ticas.org/wp-content/uploads/2019/09/casualities-of-college-debt.pdf

Barrett, Ben. “Strengthening the Partnership A Survey of Proposed Higher Education Funding Solutions.” New America. 2016 https://www.newamerica.org/education-policy/policy-papers/strengthening-the-partnership/

Campbell, Colleen. “How Congress Can Fix Student Loan Repayment.” Center for American Progress. 2019. https://vtechworks.lib.vt.edu/bitstream/handle/10919/89155/HowCongressCanFixServicing.pdf?sequence=1&isAllowed=y

Dyanarski, Susan. Kriesman, Daniel. “Loans for Educational Opportunity: Making Borrowing Work for Today’s Students”. The Hamilton Project. 2019. https://www.hamiltonproject.org/papers/loans_for_educational_opportunity

“Drowning in Debt”, Education Trust-New York. 2018 https://newyork.edtrust.org/press-release/new-fed-data-lower-income-communities-face-nearly-30-billion-student-loan-debt/

Fishman, Rachel. “Understanding Student Loan Debt, 2015 College Decisions Survey: Part IV.”New America. 2015. https://www.newamerica.org/education-policy/policy-papers/understanding-student-loan-debt/

Friedman, Zack. "Student Loan Debt Statistics In 2020: A Record $1.6 Trillion." *Forbes. Forbes Magazine, February* (2020). https://www.forbes.com/sites/zackfriedman/2020/02/03/student-loan-debt-statistics/?sh=44503e6281fe

Friedman, Zack. "Student Loan Debt Statistics In 2020: A Record $1.6 Trillion." *Forbes. Forbes Magazine, February* 5 (2020). https://www.forbes.com/sites/zackfriedman/2020/02/03/student-loan-debt-statistics/?sh=44503e6281fe.

Gold, Howard. “Who’s at fault for student-loan defaults?” Chicago Booth Review, May 13, 2019. https://review.chicagobooth.edu/public-policy/2019/article/who-s-fault-student-loan-defaults

Harris, Diane “The Truth About Student Debt: 7 Facts No One is Talking About” *Newsweek. August 8* (2019). https://www.newsweek.com/2019/08/23/student-debt-loans-truth-facts-cover-story-1453057.html.

Hedlund, Aaron. "What Can Be Done to Address Rising Student Debt?." The Center for Growth and Opportunity, Utah State University. (2019). https://faculty.missouri.edu/~hedlunda/policy/CGO_studentdebt.pdf

Johnson, Daniel. “What Will It Take to Solve the Student Loan Crisis?” Harvard Business Review. 2019. https://hbr.org/2019/09/what-will-it-take-to-solve-the-student-loan-crisis

Miller, Ben. “Who Are Student Loan Defaulters?” Center for American Progress. December 14, 2017. https://www.americanprogress.org/issues/education-postsecondary/reports/2017/12/14/444011/student-loan-defaulters/

Miller, Ben. “Who Are Student Loan Defaulters?” Center for American Progress. December 14, 2017. https://www.americanprogress.org/issues/education-postsecondary/reports/2017/12/14/444011/student-loan-defaulters/

The Institute for College Access & Success (TICAS). “Students at Greatest Risk of Loan Default” April, 2018 https://ticas.org/wp-content/uploads/legacy-files/pub_files/students_at_the_greatest_risk_of_default.pdf

Whistle, W. "Millennials and student loans: Rising debts and disparities." in “The Emerging Millennial Wealth Gap Report” New America. October 29, 2019 https://www.newamerica.org/millennials/reports/emerging-millennial-wealth-gap/millennials-and-student-loans-rising-debts-and-disparities/