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Examining variations in technology use for K-12 students of different gender and socioeconomic status

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The purpose of this paper is to review the literature currently published on how members of different genders and socioeconomic classes use technology to suit their needs in and out of the classroom learning environment. It will focus on the use of digital technologies by students in elementary, middle, and high schools. This was done by examining 30 research-based, peer-reviewed journal articles, books, published papers, documents, and observational analyses. The research indicates there are clear differences in how members of different subpopulations such as gender and socioeconomic groups choose to use technology to suit their communication, collaboration, instructional, and entertainment needs. Suggestions for future research are recommended.

EXAMINING VARIATIONS IN TECHNOLOGY USE FOR K-12 STUDENTS OF DIFFERENT GENDER AND SOCIOECONOMIC STATUS

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Abstract

The purpose of this paper is to review the literature currently published on how members of different genders and socioeconomic classes use technology to suit their needs in and out of the classroom learning environment. It will focus on the use of digital technologies by students in elementary, middle, and high schools. This was done by examining 30 research-based, peer-reviewed journal articles, books, published papers, documents, and observational analyses. The research indicates there are clear differences in how members of different subpopulations such as gender and socioeconomic groups choose to use technology to suit their communication, collaboration, instructional, and entertainment needs. Suggestions for future research are recommended.

Key words: digital technologies, gender, socioeconomic status, students

Table of Contents

Introduction

Throughout the country, there are significant numbers of school systems implementing 1:1 computer programs in their districts. Many educators who have not traditionally used technology in their instruction will have to increase their technology-curriculum integration efforts. A key component of planning effective technology integration is considering the learning needs of students. Student population demographics can help one consciously plan lessons and design instructional materials that respect each gender and socioeconomic group's preferences for technology use. Developing an understanding of what research has been conducted will give educators information about how to best integrate technology in instruction to meet their students' different needs. It will also provide educational designers with information regarding each group's most effective uses for technology and build learning environments that are inclusive for all students.

It is appropriate to look at the differences between gender and socioeconomic classes in educational settings because educators need to know what factors affect students with whom they are working. .Once teachers understand how these differences may influence students' choices in using the tools that are available to them in and out of the classroom, they can use this information to optimize lessons and increase student learning potential. This knowledge can also bring awareness of how teachers choose to use technology in their instruction based on their own preferences and biases. A study by Ritzhaupt, Feng, Dawson, & Barron (2013) found that "there were clear digital divides relative to gender, ethnicity, and the SES of middle school students in thirteen school districts" in Florida, but that all of the divides were not in alignment with what previous research had found (p. 300).

Plumm (2008) states "many teachers are not being educated as to the type and level of gender bias that exists in the technology they are using" (p. 1056). This topic is relevant because students may be receiving different instruction based on stereotypes about how genders are perceived to use technology; this topic will bring awareness of the issue. Factors like race and income are often the focus of research in sociological and anthropological fields, but they aren't often considered as topics in research about Human and Computer Interaction (HCI) (Yardi & Bruckman, 2012). "Social class, or 'socioeconomic status' (SES), is a category defined by a nexus of income level, educational attainment, type of employment ("white-collar", "blue-collar", etc.), and several other correlated factors" (Ames, Go, Kaye, & Spasojevic, 2011, p. 55). Working class families and minority groups are quickly becoming the majority population in society, so the HCI community needs to understand how to design for these groups (Ames, 2011; Yardi & Bruckman, 2012). Bringing awareness to educators will give them an idea of how to provide new opportunities and experiences while taking advantage of the strengths students display and interests they express.

The significance of this review is that it will inform teachers and administrators about the differences in how students may choose to use technologies in the classroom and how they may choose to use technologies outside of school. This knowledge will help educators plan lessons that use these differences to create the most effective learning opportunities for students.

This review will address the following questions:

1. How does gender identity have an effect on a person's preferred uses of technology?
2. How does socioeconomic status have an impact on a family's preferred uses for technology?

3. How do differences between the home and school environments affect the way students are allowed to use technology?

Methodology

The reviewer located sources using several databases. Initial searches were done using Rod Library's *OneSearch* catalog system. Within *OneSearch,* the researcher chose these specific databases: the *U.S. Department of Education Educational Resources Information Center (ERIC), ScienceDirect,* and *EBSCO Education Full Text Database*. *Google Scholar* was used to find a wider range of sources on the Internet. The reviewer used these databases in secondary searches. Rod Library's *UNISTAR Catalog* and *WorldCAT* search were used to find traditional sources such as books and printed articles.

Searches were conducted using Boolean search terms. Descriptors that were used in initial searches were *"digital equity," "digital divide," publication date (since 2010), education, "21st Century skills," gender and socioeconomic status.* The results list was large, so it became necessary to use additional descriptors to narrow the search. The reviewer found new descriptors to include in the searches by identifying key words that appeared multiple times in the abstracts of relevant sources. In the second round of searches, the researcher added *"gender stereotypes," age, "middle grades education," "secondary education,"* and *"academic misidentifications."* These descriptors narrowed the search results considerably. Later, refined searches included *internet, computers, family*, engagement, learners, ethnography, online learning, income, teen,* and *"information technology."*

In order to make analysis of the sources easier, the reviewer bookmarked relevant articles and books for review after completing searches in the databases using Diigo, an online social bookmarking, research, and knowledge sharing tool. The abstracts were read first so sources that did not address the research questions could be eliminated. Next, specific information from each source was gathered and inserted into research tables created

in Microsoft Excel so themes and commonalities between the sources could be identified. The sources were evaluated based on relevance to the research question, and then relevance to the questions' subtopics. Search limiters were used to narrow down the articles used. One search limiter was the date of publication. Primarily, articles had to be published between 2010 and 2015; if an article was published as early as 2000 and had been cited multiple times by articles published between 2010 and 2015, then it was eligible for use as well. Searches were limited to only include 30 peer-reviewed articles, books, published papers, and documents to ensure a higher quality of content.

Analysis and Discussion

This literature review will serve as a synopsis of information that was gathered from research reports about technology use by K-12 students. The literature review will focus on the areas of gender, socioeconomic status, and the transfer of skills from home to school. The first section will examine the differences in how gender may influence the way an individual chooses to use technology for his or her needs. This section includes evidence of differences in use within the areas of interaction and instructional use, communication and collaboration, and entertainment. The second section will explore the ways socioeconomic status impacts how students and their families make use of technology. There are differences in economic resources and responsibilities, devices in the home, family belief systems, purposes for use, autonomy granted to younger family members, and the support that youth and children receive as they develop technology skills across socioeconomic classes. The third section will cover the opportunities students have for transferring technology literacy skills between home and school environments.

Gender

The common belief is that men and boys are more capable of using technology than women and girls. However, research is showing that this is not always the case. For instance, Ching, Kafai, and Marshall (2000) found that males were being given more opportunities to become technologically skilled than females and to see themselves as positive characters in games. Weber and Custer (2005) identified a disproportionate amount of learning resources designed to address the ways that males and females preferred to use technologies, skewing toward male preferences. As previously mentioned, a study by Ritzhaupt, Feng, Dawson, and

Barron (2013) found girls to be equally as proficient users of Information and Communication Technologies (ICT) as their male counterparts.

Ritzhaupt et al. (2013) administered a performance-based assessment called the STL to 5,990 middle school students from 13 school districts across the state of Florida. The STL is designed to measure technology literacy. Students were tested in 5 domains based on the International Society for Technology in Education (ISTE) Standards for Students (formerly known as the NETS•S). The divide was not in the expected direction; "the results demonstrated a clear digital divide relative to gender, ethnicity, and the SES of middle school students within 13 districts in the state of Florida" (Ritzhaupt et al., 2013, p. 300). As measured by the STL, females were more proficient ICT users compared to their male counterparts. While Ritzhaupt et al.'s findings were in contrast to prior research which showed that boys at this age had better technology skills than girls, further examination of the research into specific differences can be grouped into 3 areas: instructional use; communication and collaboration; and entertainment.

Interaction and instructional use. Often, gender differences have been seen in how students interact with the computers in educational settings. Studies like the one conducted by Sadker and Sadker (1984) found that when computers were used during class time, middle school boys were more likely than girls to dominate available computer resources (as cited in Ching et al., 2000, p. 68). During scheduled computer time, the boys would rush to the computers, grab the mouse, insist on typing on the keyboard and choose the programs to use. This behavior was also observed by Canada and Brusca (1991), and Kinnear (1995) in a study observing mixed-gender pairs of students on computers. Girls' attempts to request more computer access from boys often failed, and the boys were also more likely to initiate

and maintain control of school computers during non-classroom hours such as lunch time and before or after school (as cited in Ching et al., 2000). Fokkena (2011) observed similar behaviors by elementary school students who came to her afterschool program. When students got to use computers during the appointed time, boys acted aggressively to take control of computer activities. They were quicker to grab the mouse from another child's hand, lean over another child's shoulder, take over the keyboard, criticize another child as they used an unfamiliar program, and quick to turn the device off when angered, either by another child, or by the computer (Fokkena, 2011). While the boys badgered staff for computer time, girls yielded to them and lost interest, choosing to do other activities instead. Fokkena warns that this type of interaction can be detrimental because staff members may not notice the inequity, and even worse, they may encourage it by acquiescing to rambunctious boys to calm them down.

"A number of researchers have identified common differences in the behavior of male and female students in computer supported learning (CSL) environments" (Gunn, McSporran, Macleod, & French, 2003). There is a contrast in how girls and boys consider technology's usefulness to them. Research studies conducted in the beginning-mid 2000s revealed ways that girls have been inclined to use technology as a tool for accomplishing a task, while boys have been prone to use it more as a gadget (Bain & Rice, 2006; Christensen, Knezek, and Overall, 2005; Fredorowicz, Vilvovsky, & Golibersuch, 2010; Padilla-Meléndez, et al. 2013). According to Eck, Hale, Ruff, and Tjelmeland (2002), during middle school years, most girls are very social, preferring people to things and achievement-oriented— only wanting to use a machine to help them achieve their goals. Boys are happy with competition and winning (as cited in Christensen et al., 2005 p. 33). Females tend to

view technology as a tool while males tend to view technology as a toy (Christensen et al., 2005).

Fifty-nine sixth grade students (29 boys and 30 girls) from a school in central Alabama volunteered to participate in a qualitative and quantitative study conducted by Bain and Rice (2006) to determine student attitudes and uses of technology. One of the major findings was that gender differences in computer use were not quantitatively significant. However, "Qualitative analysis indicated differences in how females and males use the computer and the amount of time spent on the computer" (Bain & Rice, 2006, p. 128). Females spent 64% more time on computers than males and most of that time was spent on an instant messenger, doing assignments, or occasionally playing games. Males indicated that they spent most of their time playing games, followed by doing homework and instant messaging (Bain & Rice, 2006). Similarly, there were also significant differences in gender-based usage patterns and perspectives on computing in Fredorowicz et al.'s (2010) study as well. Both genders used technology for completing assignments, but girls were more likely to use the computers for communication, while boys opted to use computers for entertainment purposes (Fredorowicz et al., 2010).

Fredorowicz et al. (2010) analyzed surveys completed by over 300 teenagers in middle and high schools across six states to look for patterns in how teenagers used computers to complete homework assignments. Boys and girls used computers to help with homework at about the same level in middle school. Both genders used their computers more for homework than other activities [during the week] in high school than they did in middle school. Although by high school, girls were using their computers for homework more than boys and spending more time on assignments (Fredorowicz et al., 2010). Christensen et al.

(2005) found that the amount of hours per week that girls used the web declined from 6th to 12th grades while boys increased. Even with this decline, females were still scoring higher than males in e-mail skills and in using the web in the eleventh grade.

Communication and collaboration. Females tend to prefer computer activities that encourage social interaction, whether that means communicating with others, investigating socially relevant topics, or collaborating with peers on projects and assignments. Males prefer to participate in activities that involve using technology for programming, construction, gaming, searching the web, and completing assignments while occasionally using it for communication with others (Ching et al., 2000; Christensen et al., 2005; Colley, 2003; Ritzhaupt et al., 2013; and Weber & Custer, 2005).

According to Christensen et al. (2005), the sixth grade appeared to be the point where the divergence by gender occurs. They issued the Young Children's Computer Inventory (YCCI) questionnaire to approximately 3,600 elementary and middle school students in Texas over the course of five years. In 2001, they speculated that this happened primarily because of a decline in girls' computer enjoyment rather than an increase in boys' enjoyment. Girls' computer enjoyment showed the same declining trend in the replication studies completed in 2002 and 2005.

In Ching et al.'s (2000) study, a group of 26 fifth and sixth grade students at varying levels of programming ability created multimedia astronomy resources for younger students using Lego Microworlds™. Researchers observed from field notes and videos that the girls would move to group stations around the regular classroom to talk to each other, see each other's screens, compare notes and share ideas. Because of this, they got less work done in the same amount of time than boys who did not move much. After researchers turned a lab

into a collaborative workspace, they observed girls' work behavior change almost immediately. Fourteen out of 16 boys (88%) continued to work at the isolated group stations in the regular room, and only got up when they called each other over to discuss specific problems or after they had completed their programming for the day; the other two boys worked together at one station. Nine out of 10 girls (90%) began regularly using the lab to complete their programming; they collaborated with each other, gave advice, and glanced at each other's screens while working together--staying on task for longer periods of time (Ching et al., 2000).

Weber and Custer (2005) gave the Technology Activity Preference Inventory (TAPI) to a total of 348 middle school students and 311 high school students in Wisconsin. The top five activities rated interesting by females focused in the areas of communication or design. Females expressed interest in activities that supported and facilitated communication and were of social relevance. In contrast, males expressed interest in transportation vehicles with emphasis on utilizing and constructing them. Similarly, in a study of secondary education students, Colley (2003) found that boys used the computer for playing games and girls used the computer for work and completion of tasks. She also found that boys were using the internet for searching while girls were using it for email more often (Colley, 2003).

Entertainment. Evidence from some studies suggest gender differences occur because males use the internet for entertainment and web page creation (Papastergiou & Solomonidou, 2005) and gaming (Feng et al., 2007; Glazer, 2006; and Plumm, 2008) more than females do. They also suggest that these differences become more pronounced as girls age and begin to use technology for more social activities (Bain & Rice, 2006; and Fredorowicz et al., 2010).

Fredorowicz et al. (2010) found that the stereotype of only boys using technology for gaming was not evident in the middle school respondents; it was more pronounced at the high school level. Although boys spent a greater amount of time on computer games at both levels of schooling, girls and boys exhibited similar usage patterns in middle school years. It was not until girls reached high school that the researchers noticed substantial use of applications for entertainment or social purposes by girls. Girls had replaced much of their gaming time with social networking (Fredorowicz, et al., 2010). These findings were consistent with other studies (Barker, et al. 2008; Lenhart, Madden, and Hitlin, 2005; Lenhart, et al. 2010)—they found that boys and girls diverge in their game-playing and social networking patterns as they age (as cited in Fredorowicz, et al., 2010). Bain and Rice (2006) found similar responses in their study participants: females spent most of their time on the computer using an instant messenger or in a chat room, completing assignments, and occasionally playing games. Males spent most of their time playing games, although they also used an instant messenger and completed assignments on the computer. Bain and Rice (2006) also noted that these results mirrored the findings of research done by Schofield in 1995 and Teasdale and Lupart in 2001.

Some researchers found girls were interested in games involving science if they emphasized game modes the girls were interested in, like personal interaction, instead of gameplay they thought was boring, like scoring points and violence (Dede, Ketelhut, & Nelson; Glazer, 2006; and Sheldon, 2004). Glazer (2006) interviewed Northwestern University Research Professor Justine Cassell to find out about how girls use computers. Cassell said that girls have a growing presence in social media, games and blogging. "I ask girls whether they're good at [using] computers and they say 'No' even though they are… The

traditional definition of a game excludes the kinds of things girls like. It is not true that girls do not like games" (Glazer, 2006, p. 951).

Educational software packages are usually designed for young children to use in the classroom. Sheldon (2004) identified gender representations and stereotypes of 48 different types of educational software packages designed for young children by analyzing the content of educational software. Results indicated gender bias. Sheldon (2004) found a higher number of male main characters than female main characters, although there was no gender difference for secondary characters. Female characters were more gender stereotyped in appearance than male characters. Sheldon (2004) pointed out that although many software packages included both male and female characters, just as many included male characters only. DeJean, Uptis, Koch, and Young (1999) reported that girls were much more engaged in computer use and felt more comfortable when using software packages with female main characters (as cited in Plumm, 2008). This allowed them to identify with the characters.

Making personal connections with the characters increased girls' interest in the games. Harvard researchers Dede, Ketelhut, & Nelson (2004) are a part of a team that has been working on ongoing longitudinal research about Multi-User Virtual Environments (MUVE) using a game called "River City." The team developed "River City" to teach basic science skills, (e.g., forming a hypothesis.) After 7,000 middle-school students tested the game-like simulation, they improved their scientific-inquiry skills and increased their knowledge of biology at twice the rate of peers using traditional hands-on labs. Dede et al. (2004) reported that girls trying to discover the cause of a mysterious epidemic in the "River City" simulation game approached the problem differently from boys. "Girls tried to establish a 'relationship' with the residents of this virtual town through the characters they

created, and used those relationships to solve the mystery" (Dede et al., 2004, p. 3). The "River City" Project Director Jody Clarke stated in an interview with Glazer (2006) that although research typically shows girls are not interested in science, they are. "They prefer open-ended exploration and engaging with teams, so they just do it differently. Multiplayer online games that attract female players allow team-like player networks to develop" (Glazer, 2006, p. 952).

In summary, there were three main areas where male and female students differed in terms of technology usage: interaction and instructional use, communication and collaboration, and entertainment. Each of these components showed different aspects of the gender behaviors through the way students used their skillsets to interact with the technology in their preferred ways. In some areas boys and girls displayed stronger preferences than their counterparts. Differences in interaction, communication, and entertainment were also identified between families in different socioeconomic statuses. These differences had an impact on how children in those families were able to develop technological literacy skillsets.

Socioeconomic Status

Socioeconomic status (SES) is typically broken up into three categories: high SES, middle SES, and low SES. It is usually determined by assessing an individual's income, occupation, and level of education (American Psychological Association, 2015a). According to the APA, "low SES and its correlates, such as lower education, poverty, and poor health, ultimately affect our society as a whole, in particular, America's children," (APA, 2015a, p. 2). According to Ames, Go, Kaye, and Spasojevic (2011), socioeconomic status should be viewed as an emergent category to understanding technosocial differences across both middle class and working class families.

Twenty-first century skills are now a necessary part of the educational curriculum and technology literacy is growing in vital importance for future student success. Studies conducted by Ames, Go, Kaye, and Spasojevic (2011); Yardi and Bruckman, (2012); Roshan, Jacobs, Dye, and Disalvo (2014); Swindle, Ward, Whiteside-Mansell, Bokony, and Pettit (2014); and Vekiri (2010) show that student and family human-computer interaction with ICT is influenced by the family's socioeconomic status. There are notable differences in how students from differing SES classes use available information and communication technologies at home and at school and transfer usability between the two. These differences occur within household demographics, the home environment, economic resources and responsibilities, devices, beliefs, purpose for use, autonomy, and support skills and networks.

Income disparities. The scope of the research into socioeconomic status includes studies on children who were students in grades Kindergarten through twelfth and their families. It also includes research on elementary, middle and secondary schools that serve students of high, middle, and low-socioeconomic backgrounds. In terms of income, high-income families, who Thompson and Hickey (2005) call the "upper class," make up one percent of the U.S. population, but Beeghly (2004) estimates that number to be closer to five percent. In 2013, the median wealth of the nation's upper income families was $639,400, nearly seven times the median wealth of middle-income families (Fry, & Kochhar, 2014). High-income families are more likely to use the Internet on any given day and to own multiple Internet-enabled devices. They also own more desktop and laptop computers as well as game consoles than low-income families (Yardi & Bruckman, 2012).

Pew Research Center (2014) defined middle class households as those earning between 67% and 200% of a state's median income, although this number varies depending on the state. Based on the definition of "middle class" and "upper-middle class" defined by Thompson and Hickey (2005), these groups make up roughly 47% of the United States population (as cited in Ames, et al., 2011). Kane and Kiersz (2015), analysts for Business Insider, quote the United States' median income at $52,250.00. "Upper-middle class" white-collar families make $100,000 or more annually. Lower-level, white-collar, "middle class" families' incomes range between $32,500 and $60,000 annually (Alhanati, 2012).

Thompson and Hickey's (2005) "working class" families find themselves at the very bottom of the "middle class" or top of the "lower class" depending on the state where they reside, as they have an earning potential of $23,000 to $32,000 annually (Alhanati , 2012). Families at the poverty level may earn between $18,000 and $23,000 per year, but if they reside in urban areas, a high cost of living could "Lower class" categories make up approximately 52% of the U.S. population. These families have an earning power of less than annually. Among families making under $30,000 annually, 59% have computers at home and 75% have mobile phones (Yardi & Bruckman, 2012). Combined with the growing wealth gap along ethnic and racial lines, these trends could mean that the "typical" HCI user is more likely to be a person of color and lower to middle class.

Ames, Go, Kaye, and Spasojevic (2011) conducted a qualitative ethnographic study to find out parents' attitudes about their children's uses of technology. They used a value-centered approach, which accounts for human values throughout the design process, where a value "refers to what a person or group of people consider important in life" (Ames, et al., 2011 p. 56). They interviewed 22 diverse families in the San Francisco Bay area (with 36

parents and 39 children). They divided the families into two separate groups based on their income and working life, but they also saw distinct differences based on education, community, mobility, and parenting styles. Twelve of the families were considered "middle class and ten of the families were "working class" (Ames, et al., 2011). Nine out of twelve families had nuclear family structures with limited extended family, while the families in the "working class" had a variety of family structures that included more single parents and extended family members. All twelve "middle class" families had a parent working in a professional job (eight of them in software development or computer hardware design) and the "working class" parents held a variety of lower-status white-collar and blue-collar jobs (Ames, et al., 2011 p. 57).

In another qualitative study, Yardi and Bruckman (2012), interviewed 16 middle to upper class parents (2 fathers and 14 mothers); all of these participants were engaged in two-parent, heterosexual relationships with between 1-4 children. (p. 3041). They also interviewed 18 low-income, African American parents to explore how social structures affect technology adoption within families. These researchers used a grounded theory approach to determine high-level themes that occurred throughout the transcript from each interview. The families in this study were grouped according to where they lived geographically. The high SES families lived in North Atlanta and the low SES families lived in South Atlanta. The high SES families were recruited from a private school where most students were from upper and middle class families and the low SES families were recruited from two community programs that served people in economically disadvantaged communities. They found that parents in each socioeconomic group found it challenging to monitor how much technology

their children used and the quality of the content accessed. However, parents chose varying approaches to addressing those challenges.

Roshan, Jacobs, Dye, and Disalvo (2014) conducted a qualitative study to find out how parents in financially depressed areas access information technologies and out-of-school learning resources to see how the parents' knowledge affects their use of out-of-school learning resources for their children. They interviewed 28 parents (who all identified as African American) from the west side of Atlanta to find out about their use of information technologies, everyday practices, cultural values, and how they use technology to find learning opportunities. Roshan, et al. did not give a numerical breakdown of the family structures of study participants to avoid giving a disproportionate image of the families in the community.

Family Factors.

Results from studies conducted by Ames, et al. (2011); Roshan, et al. (2014); and Yardi & Bruckman (2012) show that there are differences in personal usage patterns among socioeconomic lines. These differences were influenced by financial resources and responsibilities, parental views on technology's importance in their homes, sharing available devices, and parent's technology literacy. When it came to children's safety and responsibility, the families in the different socioeconomic classes had some similar goals and practices in their homes. However, families made contrasting choices when they had to consider factors like economic responsibilities, devices that were accessible in the household, and autonomy for family members.

Economic resources and responsibilities. Yardi and Bruckman (2012) found that high SES parents who already had their own individual laptops were more likely to purchase

individual laptops for their children for communication and educational purposes at an earlier age (early middle school), while middle and low SES parents tended to buy desktop or laptop computers for the family to share. Middle SES families invested in individual computers for students when they reached more mature ages (secondary level or college-bound). Low SES parents either prioritized sharing existing household devices or passing down old ones to the kids, although some families still bought devices for children as well. Roshan, et al.'s (2014) findings reinforce the abovementioned finding by showing that low SES families who had computers at home shared them and families who didn't had to make use of free and inexpensive options available to them in their communities. A report by Becker (2010) showed that 44% of all age groups and 61% of young Americans (aged 14–24 years) living in poverty used the public library for computer and Internet access (as cited in Swindle, et al., 2014). Almost all of the students in Henderson's research (2011) talked about how they had access to a computer at either a relative or friend's house or through their membership at a local library if they didn't have a functioning one at home. For some of the students, the library was the 'cheapest' option, so it was visited regularly. Twenty-five of Roshan, et al.'s 28 participants (89%) had laptop or desktop computers at home, and the device was usually shared by the family (2014).

Devices. When interviewing parents, Ames, et al. (2011) did not define "technologies" for parents, but instead, left the meaning open for interpretation to allow them more freedom in discussing their decision-making. The researchers noticed that parents focused on television, video games, computers, and mobile phones (p. 59). Ames, et al. (2011), Roshan, et. al (2014), and Yardi & Bruckman (2012) all found that cell phones and video games were purchased more often in low SES households due to their affordability,

accessibility, and high mobility. Results from Swindle, Ward, Whiteside-Mansell, Bokony, and Pettit's (2014) study of technology use in low-income families suggest that cell phone use by low-income families is similar to rates of cell phone use by those of higher socioeconomic status and is higher in some cases. Video games were also purchased consistently among low SES individuals.

Yardi and Bruckman (2012) hypothesized this was because these devices offer entertainment, connectedness, and status at relatively affordable prices. Participants talked about how social status and stigma were associated with different devices; these factors influenced purchasing decisions for families from all backgrounds. Some low SES parents told researchers that their children did not like prepaid cell phones because there was a stigma against them. The parents put their children on flat-fee plans like Metro PCS because they were worried about high cellphone bills. Children in families from the Yardi and Bruckman (2012) and Ames, et al. (2011) studies had expressed mixed emotions to their parents about these plans because often, the plans came with simple mobile phones that did not have a lot of capabilities. Occasionally, students faced some teasing from their peers for not having popular devices. A parent from Family 9A said, "It's just considered an amateur phone. In the same way they might like Michael Jordan more than New Balance. It's a status symbol" (Yardi & Bruckman, 2012, p 3047). This teasing was not just limited to children from low-income households. One student in an upper-middle SES family from the San Francisco Bay Area told her parents that she did not take her laptop to school because it wasn't "a Mac like the others have" and any laptop that wasn't a Mac was considered "lame" (Ames, et al., 2011, p. 62).

Eamon (2015) analyzed data from the National Longitudinal Survey of Youth (NLSY) and the NLSY mother/child data sets to see whether poor and non-poor youth had home computers and when and how they used those computers. Her sample contained 1,029 children of the original NLSY female cohort. She found that more than 87% of non-poor youth had functioning home computers and 55.8% of poor youth had a functioning home computer, and of those youth who had computers, 96.7% said they used the home computer (p. 99). When the youth were using the computers, it was most often because their parents believed the computers were being used for acceptable academic purposes.

Beliefs. "Parents are important facilitators for informal learning among their children, and how parents utilize technology to find resources and ideas for informal learning impacts a child's exposure and interest in education" (Roshan, et al., 2014).

In several studies, researchers found that lower SES families were more likely to view technological literacy as a way to gain access to resources that previously weren't available to them and for children to get a competitive footing in the world as they work toward upward mobility (Lebens, e al., 2009; Vekiri, 2010). It is a means of gaining status and promotion on to better things. As a result, these families would encourage more frequent use of technology in their households than middle class families. In mid-SES families, parents tended to take a cautious attitude toward technology use and restricted television, video games, cell phone, and computer use for their children (Ames, et al., 2011). They also monitored content by restricting access to the devices. Vekiri (2010) went on to say that these differences in attitude toward ICTs may also have an impact on the learning opportunities parents seek out for their children to participate in and the values about use that they teach

and enforce. These values guided the purposes for using technologies, the autonomy with which family members accessed technology and the skill levels of family members.

Purpose. Participants in the studies conducted by Ames, et al. (2011); Eamon (2015); Gurung and Rutledge (2014); and Yardi & Breckman (2012) discuss multiple uses for technology in their homes. Three areas that were the most prominent were safety, nurturing family connections, and fostering learning and information retrieval.

Safety. Parents in all three socioeconomic groups expressed their concerns about children's safety while using technologies, but parents in the low SES group specifically mentioned using technology to assist them with keeping their child safe (Ames, et al., 2011; Yardi & Breckman, 2012). Many of the working class parents in Ames, et al.'s study had work schedules that would not allow them to transport their children to school and other activities on a regular basis like the middle SES parents (mostly moms) could. The working class parents said that mobile phones were one of the best ways to keep track of their kids' comings and goings and to make sure they were okay, even when entrusting them to the care of extended family members (Ames, et al., 2011). Similarly, the lower SES parents who were interviewed by Yardi and Bruckman (2012) shared the sentiment saying that they wanted their children to have cell phones for contacting [parents] when they took the bus and for safety and emergencies. The high SES parents they talked to usually wanted their middle school kids to have phones so that the family could coordinate after-school pick-ups and carpools in real-time.

Building family connections. Parents in both the middle class and lower classes in Ames, et al.'s study (2011) valued togetherness, their children's education, health, and well-

being. They said that technology was a great tool for communicating with family members who did not live near them, but they did differ on how much technology should be used to connect with family. Some of the middle class families in the study relocated to the Bay Area so that one parent could work in the technology industry. As a result, they were living far from extended family members. These parents ritualized family phone calls and video calls with distant relatives to maintain contact. Working class parents who Ames, Go, Kaye, and Spasojevic (2011) talked to in the study were not as strongly opposed to using television and games for family bonding. Five out of ten of the working class families said they incorporated television into the nightly bedtime routine as a way to wind down (p. 62). Like the middle class parents, the working parents reported reading to their children, helping them with homework, and eating dinner together at the table; they just considered watching television to be another path for bonding. The middle class parents were very adamant that technology like computers, televisions, and games interfered with family bonding and they gave their children strict time limits for using them each day. Often, they expressed guilt for using technology as a "babysitter," or for being a "bad parent" whenever they let their children use the technology for longer than normal because it cut down on personal "family time." Usually, the extra time came when parents were cooking, cleaning, or working (p. 60). The exception to this rule was found when half of the middle class parents talked about using the Nintendo Wii console to play games as a family. They considered the console and games to be "good" technology and a family-friendly that everyone could enjoy together.

Learning and information retrieval. The data that Eamon analyzed showed that 19.63% of youth who had functioning home computers only used the computer for academic purposes, and that there wasn't significant difference between poor and non-poor students

(Eamon, 2015, p. 99). Youth reported using their computers more for non-academic purposes like gaming, surfing the internet, social networking, and viewing/listening to streaming content. Vekiri (2010) cited several studies involving different age groups of students that have shown that "home computer use is associated with positive computer attitudes and beliefs (Bovée et al., 2007, Meelissen and Drent, 2008, Selwyn (1998 and Van Braak, 2004), low computer anxiety (Bozionelos, 2004), and better utilization of school ICT resources (Selwyn, 1998)" (p. 941). Participants in a study conducted by Gurung and Rutledge (2014) used computers to access their learning management system, Odysseyware® and to complete learning activities and assignments. Their engagement with assignments was varied, proactive, multi-faceted, mixed, and dynamic because they got to individualize their learning to meet their own needs. As a result, students were able to take elective courses that interested them, personalize their use of technology for learning engagement, and graduate from high school on time (p. 98).

Autonomy. The families in each of the socioeconomic groups had guidelines for how technology would be used in their homes; some were more rigid in defining who would be able to use technology and when, while others were more lenient. According to Roshan, et al. (2014), autonomy is the degree of control and flexibility one has over their internet use. Since families don't often provide all members with their own individual computers, televisions, and games, some parents have found it necessary to provide guidelines for family members' access and use of these technologies. In her research, Vekiri (2010) found that there were "significant SES differences in parental regulation and guidance of students' ICT use at home" (p. 946). Among the students who used a computer at home, low SES students were less likely to report that there were specific rules in their families regarding when and

for how long they could use the computer and/or the internet (42.6%) or what they could do while using the computer and/or the internet (36.8%), compared to students from middle SES (51.4% and 41.9%) and upper-middle SES families (67.4% and 52.9%) (p. 946).

The twelve middle class parents in Ames, et al.'s study (2011) structured their children's time with information and communication technologies. Most of them practiced caution and restraint, citing the results of reports in parenting magazines or information from pediatricians and other parents as reasons for their caution. A couple of the working class families in the study also restricted their children's access to some technologies because they felt like it was interfering with school work, socialization, or exercise and play, although not as strictly as the middle class parents. They also tended to have less technological familiarity and their attitudes toward technology were more mixed: they were generally more permissive, and their children more often had personal access to technologies shunned by middle class parents, such as personal mobile phones or televisions in their bedrooms

Sharing resources. Some families in different SES groups were more prone to sharing devices than other families, and the extent parents controlled devices varied by age, allotted "screen time," and ownership (Yardi & Bruckman, 2012). Findings from Ames, et al. (2011), Roshan, et al. (2014), and Yardi and Bruckman (2012) showed that low SES families were more inclined to share devices like computers and tablets than middle and high SES families. Some adult participants in these studies could not use devices whenever they wanted to because they yielded to their children. The device most parents and teens had individually was a mobile device (Yardi & Bruckman, 2012).

High SES parents rarely shared personal desktops or laptops with their children, especially once the children reached middle school age and older. When these parents

decided their children needed a personal computer or a cell phone for homework and communication, they chose to purchase the devices for their children (2012). Middle SES parents who did not want their young children to have full access and ownership created environments where the children shared a family computer. For many low-income families, however, sharing a computer was not a choice. Low SES parents reported that sharing posed challenges for them, such as the logistics of trying to coordinate computer time (2012). Parents did concede that although sharing the computers restricted how much time they could use the devices, it did make it easier to monitor their children's' activities more often.

One glaring disparity between the SES classes was that six out of ten working class families in Ames, et al.'s study (2011) allowed children to have televisions and sometimes DVD players or game systems in their bedrooms (p. 63). For three of these six families, the devices were gifts from a father who didn't live in the household. Televisions were not allowed in any of the twelve middle class households in the study. Ames, et al. reported that several parents directly stated that they would never allow their children to have a television in their bedroom.

"Screen time." The most common phrase used among middle class families to explain when children were permitted to use technology was "screen time." Increasingly, middle class parents have considered television, video games, computer/internet, and cell phones to be "technology" (Ames, et al., 2011, p. 59). Their specific concerns about technology often involved concerns about violence, sexuality, online predators, consumer culture, as well as concerns about the consequences of unrestrained technology use, such as obesity, attention-deficit disorder, eye strain, and anti-sociality (Ames, et al., 2011, p. 61). Ames, et al. (2011) and Yardi and Bruckman (2012) found that middle class parents did not generally distinguish

between technology and the content children accessed with the technology separate: restricted the technology in order to limit the effects of both.

Lower class parents tended to be more lenient about allowing children to use specific forms of technology depending on what they were trying to do. Only a few lower SES parents in Ames, et al.'s study regularly restricted the amount of time their children watched television the way many middle class parents did. Working class parents tended to treat the content (particular television shows, websites, and video games) separate from the technology or platform they were on, expressing control by placing restrictions more on the content more than the technology. (Ames, et al., 2011, p. 59). One finding from Roshan, et. al's (2014) interviews was that 75% of study participants chose to limit their children's access to online services. These decisions were based on two things: parents' concerns about the vulnerability of their children toward online threats and the desire to keep them safe, and the risks of viruses and malwares that could affect the performance of devices that the whole family had to use (2014, p. 135).

Gradual release of responsibility. Parents across demographics had similar rules for young children 5th grade and younger and middle school students. Parents didn't think younger children needed computers for school work unless they had a project to complete; computers were mostly for fun and play. Parents in both low SES and middle SES groups believed that middle school was an appropriate time to begin allotting regular computer time for homework (Yardi & Bruckman, 2012). High SES parents reported that middle school was when their children began to receive their own personal devices and online accounts (e. g. Facebook). Middle and lower SES children began getting their first online accounts and cell phones (for those who don't already have phones) in middle school as well; but some middle

SES families decided to wait until children were teens before getting them personal cell phones (Ames, et al., 2011; Yardi & Bruckman, 2012). For parents, transitioning into this new stage of parenting was a difficult process because some parents were not technologically savvy and children needed guidance navigating the responsibilities that come with having their own devices. Low SES parents had the added concern about their children breaking mobile devices, because they did not always have the financial resources to replace them (Roshan, et al., 2014; Yardi & Bruckman, 2012). One noticeable difference between lower SES families and middle and high SES families was that the lower SES families would allow older children to have a television in their bedrooms (Yardi & Bruckman, 2012). As soon as they were old enough, teens in lower SES families were encouraged to get a job in the transition toward adulthood. These teens' gained more autonomy in their use of devices before their middle and high SES peers because they could use their income to buy their own devices and games and their parents let them make choices about use.

Support networks and skill development. "Skills describe not only the individual's ability to deal with ICT devices but also the availability of help and support in their social network" (Lebens et al., 2009).

Support networks. Roshan, et al. (2014) placed emphasis on the importance of social support as a factor for users of online services. This is particularly important for inexperienced users who may need help with completing unfamiliar tasks. Receiving help with technical problems may decrease participants' frustration and motivate them to continue using technology. Socioeconomic differences in parents' beliefs about information and communication technologies may impact their influence on their children's relationship with ICT not only by providing technological resources but also by creating learning opportunities

(Vekiri, 2010). How parents used technology also impacted their kids' uses. Yardi and Bruckman (2012) observed that parents who got confused easily or had the most concerns were the least likely to use social media themselves and could not teach their children how to use the sites (p. 3048).

Parents in all SES classes reported that it was hard to keep up with what their kids were doing online. Most of them assumed that their children knew more than they did about technology and that at times, it could be overwhelming (Yardi and Bruckman, 2012). Some of the parents in Yardi and Bruckman (2012) and Ames, et al.'s (2011) studies had taken classes to learn more about computers; other families had talked to parents in their social networks for advice. Some used the local Apple store as a resource while others visited local community centers (2012). Parents used these times to ask professionals and peers for strategies to help them monitor their children's activities and keep them safe on computers and the internet. Parents in middle and lower class SES were familiar with checking history as a tool for surveying their children's browsing activity. Most of the parents knew that their kids (especially teens) were figuring out how to hide their browsing habits by deleting or using private browsers. High SES parents in Yardi and Bruckman's study were the only group who did not mention private browsing and only a few mentioned checking to see if their children had deleted items from the browsing history. Many parents had even tried blocking inappropriate websites and content for Internet use (2012, p. 3045).

Skill development. Students who thought that their parents encouraged them to use computers had positive views about their computer abilities and skills. Roshan, et al. (2014) noticed a theme among the parents they spoke with: there was a disconnect between their actual technical abilities and their perception of their capabilities.

Vekiri (2010) talked to fifth and sixth grade students who came from diverse family backgrounds; her sample included students from upper-middle, middle, and low SES families. Students from all SES levels sensed that their parents wanted them to develop ICT skills. Middle SES respondents reported the most parental support and family value beliefs while high SES students had the highest self-efficacy and engaged in the widest range of ICT activities (p. 945). The lower SES students did not have many opportunities to develop ICT competencies outside of school and had a narrower range of skills using various ICT applications (p. 947). Students from middle and low SES families relied less on their parents (41.8% and 31.6%), and turned to siblings, friends or other people when they needed help or wanted to learn something new about computers.

The home environment has an impact on how students interact with technology and develop information and communication skills. However, this isn't the only place students access technology and learn how to use it to suit their needs. Formal education is where some students gain access to technologies and learn how to use them to suit their needs. There is possibly a contrast between technology use at home and at school. This next section will examine how socioeconomic status may affect they way students transfer their technological skill sets and technology use from home environments to structured school environments.

Home to School Connection

According to a Futurelab report cited in Green et al. (2005), "by the age of 21 the average person will have spent 15,000 hours in formal education, 20,000 hours in front of the TV, and 50,000 hours in front of a computer screen" (p. 4) (as cited in Henderson, 2011, p. 152). If this is indeed the case, a person will have spent more four and a half times as many hours interacting with a screen than learning by formal means. Vekiri (2010) cited several

studies that showed students had access to devices at home years before they could receive formal instruction in how to use them at school; and even then, it was not integrated into the teaching of school subjects (p. 948).

The teachers in Henderson's study (2011) considered computers to be a digital technology that students needed to learn in order to ensure successful future lives. They didn't place too much emphasis on games or mobile technologies. Yet students indicated that computers were one technology that they used outside of school and could choose to help them achieve goals they set for themselves (p. 156). Children from low SES households in Lebens, et al.'s study (2009) recognized the importance of computers and ICT skills as an essential component for their educational and career goals. Unlike their high SES peers, these children also expressed a lack of confidence about their skills using the computer, even though they had plenty of resources at their school. Vekiri (2010) stated that unless school ICT integration takes into account student differences in prior experiences, attitudes, knowledge, and beliefs, and attempts to build their skillsets, students from low-income families may not benefit equally from ICTs' learning potential at school (p. 941).

A divide that follows social class lines results in differences in the ICT knowledge and skills that students acquire outside of school. A teacher's expectation that his or her students are already skillful computer users may put those students who have not had the chance to acquire these skills at a disadvantage (Heemskerk, et al. 2005, p. 2). Despite the school policy and teacher restrictions, the participants in Gurung & Rutledge's study (2014) pushed the boundaries by mixing personal and academic uses for technologies. They practiced their digital habits (like listening to music, texting, and using social networks) in the classroom when it suited their needs. Gurung and Rutledge call this "overlapping" - when

people's personal digital habits and interests "naturally" occur in their classroom, when these digital habits and interests influence their choice in electives, or when their interests and digital habits were even a part of their career plan (Gurung and Rutledge, 2014, p. 99).

School Environment Based on their research, Judge, Pluckett, & Bell (2006) stated that differences in access based on school-poverty status had diminished, but differences in computer use associated with school-poverty status continued to exist. They said that students from high-poverty schools used computers more for drilling practice in reading and mathematics skills, whereas students from low-poverty schools used computers more for accessing Internet functions (p. 58). Four years later, a survey conducted by Gray, Thomas, & Lewis for the National Center for Education Statistics (2010) reported that in-school computer access had become relatively universal. In a national 2009 survey of 3150 teachers, 97% of teachers reported access to computers, with 96% of computers in schools having Internet access (p. 3). Martin proposed that digital divides still existed, but the concept is still frequently misunderstood as a "hardware divide", which arises due to a lack of access to ICT resources instead of a three-dimensional divide: an inequity in motivation, possession, and skills (as cited in Lebens, 2009, p. 257). Henderson (2011) agrees that the divide is not about which groups have access to resources and which groups don't, but between the "rich literate practices used by young people in their homes and the narrow and restricted practices engaged in by schools and teachers" (p. 153).

In 2012, Blackwell, Lauricella, Wartella, Robb, and Schomburg (2013) collected online survey data from 1,329 early childhood educators to find out how they accessed and used different technologies, how they felt about using technology in their teaching, and receiving professional development. In 2013, Blackwell, Lauricella, and Wartella (2014)

extended their research to survey 1,457 educators to investigate factors that influence how teachers use specific technologies. They found that factors like personal teacher demographics, program types, and student SES have significant influence on the actual use of technology in the classroom.

Gurung and Rutledge (2014) conducted a qualitative study at a public alternative high school in the 2010-2011 school year with students at South West Alternative High School (SWAHS). Most of the students were from low-income families and from diverse backgrounds. SWAHS was selected as the research site because "it had developed and implemented a technology-integrated Triad model into the curriculum and instruction of core content areas, and b) the students at SWAHS were quintessentially digital learners" because they fit the "digital learner characteristics" outlined by Tapscott (2009) (p. 93).

Gray, et al.'s 2010 report provides national data on the availability and use of educational technology among teachers in public elementary and secondary schools during 2009. Data was gathered from 4,133 teachers working in 2,500 public schools throughout the 50 states and District of Columbia using a Fast Response Survey System. The survey covered:

- the number of computers located in each teacher's classroom
- internet access for computers in the classroom
- availability and frequency of use for computers
- the frequency that teachers used systems on the school or district network
- remote access to computer applications or data

- types of software and internet sites used for classroom preparation, instruction, and administrative tasks
- students' use of technology during classes (p. 1).

Results from the survey showed that 97% of teachers had one or more computers in the classroom every day, and the student to computer ratio was 5.3 to 1. Teachers reported using computers during instruction often 40% of the time and sometimes 29% of the time. Differences were found among low and high poverty schools for the percentage of teachers who sometimes or often: used email or list-serve to send out group updates or information to parents (69% compared to 39%) or to students (30% compared to 17%), used email to address individual concerns with parents (92 percent compared to 48 percent) or with students (38 percent compared to 19 percent), used a course or teacher web page to communicate with parents (47% compared to 30%) or with students (36 % compared to 18 %) (Gray, et al., 2010, p. 5, 15-18).

Accessing technological resources. Based on data for how many teachers had access to certain technologies, Blackwell, et al. (2013) divided technologies into two categories: ones that were universally available (75% or more teachers had access to them), and ones that were newer and less available (30% or less teachers said they had access to them). They used this data to compare and contrast differences in use. Universally available technologies were TV/DVDs (79%), laptop or desktop computers (83%), and digital cameras (92%). Newer mobile technologies were non-video iPods/MP3 players (21%), iPod touch devices (15%), e-readers (15%), and tablet computers (28%) (p. 314). Results from the study also indicated teachers in programs with middle income students had less access to several

technologies compared to other teachers. Teachers of middle-income students had less access to iPod/MP3 players compared to teachers of upper-middle income students. They also had less access to tablet computers compared to those with upper-income students. Finally, teachers of middle-income students also had significantly less access to computers compared to teachers of low-income students (p. 314).

Students had individual laptops to use in class, access to a computer lab, a media lab, and a Cybercafé. They received direct instruction from teachers, used computers and online learning resources for independent study, online electives, and credit recovery, and completed projects to demonstrate learning. Five students with diverse demographic representations were chosen for personal interviews; these participants represented the school demographics including: race/ethnicity, socioeconomic background, gender, and academic grade level as much as possible (Gurung & Rutledge, 2014, p. 93-94).

Henderson (2011) was able to gather data about how teachers use technologies and different pedagogical strategies in two middle school classrooms in two different schools that were located in low socioeconomic areas in Australia for one school term. Both teachers were experienced and had been using technology in their classrooms prior to the study. Both classes had four computers in the classroom and access to functioning computer labs which were in other classrooms and open to other classes in the school (p.154-155). In direct contrast, many of the public schools attended by the low SES children in Yardi and Bruckman's study were under-funded and did not have a proportionate amount of working computers with Internet for the student population, and the local library was instead used as a computer and Internet resource center (p. 3044).

Table 3 in Gray, et al.'s report (2010) shows that teachers reported having the following technology devices either available as needed or in their classrooms every day: LCD (liquid crystal display) or DLP (digital light processing) projectors (36% and 48%), interactive whiteboards (28% and 23%), and digital cameras (64% and 14%). Of the teachers who had available devices, the percentages that used them sometimes or often for instruction was 72% for LCD or DLP projectors, 57% for interactive whiteboards, and 49% for digital cameras (p. 7-8).

Economic Resources. Blackwell, et al. (2013) state that their research suggests student income level may be correlated with access to and use of technology, given that schools with lower student SES often have lower access to more pricy technology due to limited funding. Teachers in these schools report using technology less often (Gray et al., 2010). Their findings showed differences in access between certain types of classroom teachers and home-based providers. Extrinsic factors like a school's type and student income level had a direct correlation to whether or not teachers had access to technologies. Home-based programs were more likely to have access to e-readers. More school-based programs also had access to tablet computers compared to center-based care. Head Start programs were less likely to have access to TV/DVDs compared to all other programs. Center-based programs had significantly less access to computers compared to all other programs; Blackwell, et al. thought this was odd since prior research by Wartella et al. (2010) found no difference in computer access between classroom teachers, including center-based care, and family providers (as cited in Blackwell, et al., 2013).

Lebens et al. (2013) pointed out that too often, policy makers have fallen into the trap of investing more and more money into buying technologies to alleviate a "digital divide"

and mandating that schools buy devices without addressing a specific purpose and ensuring the resources are appropriate for instruction. As a result, educators end up with a supply of devices that they do not know how to use, or don't see a need for in their instruction; and devices go unused (2009, p. 256-257). Blackwell, et al. (2013) recognized similar outcomes from a sudden influx of technology: teachers get the opportunity to integrate technologies into the classroom, but extrinsic barriers like performance expectancy, effort expectancy, social influence, or personal barriers end up influencing the way technology is used.

Instructional Practices. Computers were once thought of as the hardware catalyst for education reform, but the technology itself cannot do much to alter the education landscape or provide enhanced outcomes for students if there is a failure to best use technology for instructional purposes (Blackwell, et al., 2013). Teachers in the NCES survey reported that they or their students used computers in the classroom during instructional time often (40%) or sometimes (29%). Teachers reported that they or their students used computers in other locations in the school during instructional time often (29%) or sometimes (43%) (Gray et al., 2010, p. 3).

Blackwell, et al. (2014) found that support, technology policy, and teaching experience had positive direct effects on technology use. Student SES had a negative indirect effect on use mediated by teacher attitudes, and support had the second largest direct effect on technology use, suggesting that this is critical to technology integration in the early childhood classroom. (p. 87). In addition to support, having a technology policy and teaching experience also had positive direct effects on technology. They found that teachers with more experience used technology more often, which was the opposite of their hypothesis. Student SES had the largest negative direct effect on attitudes, so teachers who served higher income

students had less favorable attitudes while teachers who worked with students from lower SES families had more positive attitudes. In turn, attitudes toward technology for children's learning and confidence had two of the strongest positive effects on technology use, supporting Blackwell, et al.'s (2014) prior research from 2013 that showed teacher attitudes toward and confidence using technology play a critical role in their use of technology in the classroom (p. 87-88).

Teacher interaction. While belief systems impacted their practice with technology, the teachers also felt constrained by extrinsic factors (Blackwell, et al., 2013, p. 311). This response from teachers echoed Inan and Lowther's findings (2010) that personal efficacy and beliefs about the benefits of technology influenced actual use. Extrinsic factors, such as school support, and professional development, helped shape teacher readiness and attitudes toward technology (as cited in Blackwell, et al., 2014). Results from research conducted by Blackwell, et al. (2013), Henderson (2011), Judge, Pluckett, and Bell, (2006), Thorpe, Hansen, Danby, Zaki, Grant, Houen, Davidson, and Given (2015), and Weber and Custer (2005) all reflect that teachers would like to receive more professional development. Teachers from Grey, et al.'s (2010) survey reported that the following activities prepared them (to a moderate or major extent) to make effective use of educational technology for instruction: 61% for professional development activities, 61% for trainings provided by school technology support staff, and 78% for independent learning (p. 18).

Teachers have admitted that they don't know as much as they would like to about working with technologies in their classrooms. They feel that students probably know more than they do about using the technologies (like bypassing filters for websites) and it makes them hesitant to use the devices in their instruction. The frequency of professional

development sessions about using the technologies with students increased use of computers and tablet computers. Compared to home-based schools, other schools began to use e-readers and TV/DVDs less frequently (Blackwell, et al., 2013).

Even though much has been said about the need for teachers to ensure that 'new' literacies are included as part of classroom practice (The New London Group 1996; Anstey & Bull 2006), schooling has tended to privilege a narrow range of texts (as cited in Henderson, 2011). The two teachers in Henderson's study (2011) said that often, external influences affect their ability to include more ICT instruction in their classes. The teacher from School A said that a lack of time and competing demands were impediments for her: "I'm flat out with the English and Math that I have to do these days with all the interruptions that there are." (p. 156). The Internet provides an avenue for students to solve real-world problems and complete assignments that are authentic and current. Information and communication technologies facilitate differentiation and individualization in education to fit the needs and interests of students. Today's students can participate in events anywhere in the world through online connections, but schools don't take advantage of these opportunities as much as they should and use students' strengths in the classroom. Often, it's because schools don't have access to the range of technological devices and funds to buy these devices as students do in the outside world. (Heemskerk, et al., 2005; Henderson, 2011).

Student interaction. However, having the technologies does not guarantee the skills will be taught. For instance, in the above-mentioned study about SWAHS-alternative school, Gurung and Rutledge (2014) noted students were provided with adequate technology access and instruction to place emphasis on using technology to foster independent learning. Students rarely used the Internet and other technologies to the maximum potential while they

were at school for higher level skills like critical thinking, problem solving and collaboration in the classroom. Outside of class, their usage was more abundant and varied depending on their personal "digital habits." (2014, p. 94-98). The flow of ICT usage between home and school does not happen fluidly and students' mastery of skills suffers for it.

Conclusions and Recommendations

Conclusions

This literature review has examined the different ways students from gender and socioeconomic classes use technology to learn in formal educational settings and home environments. This information is relevant to curriculum development because classroom populations are diverse and students should benefit from using digital tools for academic learning in and out of traditional classroom settings. Conclusions drawn from the results of research about gender differences in use will be discussed and then differences between socioeconomic classes will be addressed. The transfer of technology skills between home and school environments will be covered.

Gender.

There are differences in how boys and girls choose to use technology; these differences are not in how they access resources, but in the ways that boys and girls interact with equipment, and how they prefer to use technology for instruction, communication, collaboration, and entertainment. Students have access to powerful machines so it is imperative that educators find strategies for helping students make the best use of them. Research conducted on gender differences in technology during the late 20th century focused heavily on whether there was equivalent access to resources for both genders. Now at the beginning of the 21st century, particularly in the 1:1 learning environment, research has shown that equivalent access between genders is no longer as significant as it once was in determining when and how males and females choose to use the technology that is available to them. The studies in this review strongly reinforced the point that gender preferences in

use have a dynamic role in the ways computers were used by students (Ritzhaupt et al., 2013; Plumm, 2008; Fredorowicz et al., 2010).

This review explored the ways that students of different genders use technology differently. Females preferred to use technology as a tool to get work completed and foster social connections. Girls are more confident and proficient in manipulating technology when they are using it for an area they have a strong interest in. Girls appreciated social aspects to completing group work and open-ended exploration of games they played in their free time. Girls in the Dede et al. (2004) study even created personal connections and backstories for the characters in games they played in school to make them more relatable.

Males tend to see technology as an object to manipulate and a challenge for them to master. Although they do use the social aspect of computer technology occasionally, it is not their primary purpose for use. Overall, they showed a preference for using face-to-face communication instead of using an online tool to communicate. Young boys are aggressive users who confidently take charge of the equipment and know what they want to do when using technology. They often spent more time on the computer gaming and their competitive nature was reflected in the types of games they preferred to play. The aggressiveness subsides as they mature, but their intent for using technology strengthens. This has made them more independent when using the technology as well as taking steps to troubleshoot computer problems on their own.

Technology does not change students' work habits, but it does reflect how they prefer to work individually and collaborate with peers on group work. Ching et al.'s (2000) study, showed differences in how girls spent a lot of time collaborating with each other when programming while boys spent more time working to complete their tasks individually and

only talked to each other when they found it necessary. These differences in use by males and females, no matter how subtle, must be considered.

Socioeconomic status.

There are also differences in how different socioeconomic classes look interact with information and communication technologies. These differences aren't a reflection of "The Haves and the Have Nots," but of what each socioeconomic class does with what they *do* have. As Ames, et al. stated: "The very real differences between families raises issues of how one inclusively designs across class more generally, which we argue must take into account differing values and structural realities" (Ames, et al., 2011, p. 63). Findings from studies have proven that lower SES class students have access to many digital technologies and are just as likely as their higher SES class and middle class peers to use them to suit their needs and interests (Ames, et al., 2011; Gurung and Rutledge, 2014; Roshan, Jacobs, Dye, and Disalvo, 2014; Yardi & Breckman, 2012). Socioeconomic lines are fairly clearly drawn in the United States and often attention is focused on addressing the needs of the middle class, which makes up the majority of the country; instructional materials are not any different. For example, if designing materials that support middle class family values means placing limitations on technologies, but working-class parents values encourage increased access to technology how would these values be resolved in design? (Ames, et al., 2011; Yardi & Breckman, 2012).

Designers are creating learning materials that fit the needs of the majority group, but when different socioeconomic groups have values that don't completely sync, where does that leave the other parts of the population? The literature in this review shows that higher SES families, middle SES families and lower SES families don't view technology usage the

same in their homes and don't emphasize the same values when it comes to using these technologies.

Home to school connection.

Home environments promote different values and beliefs about technology usage, endorse the use of certain devices more than others, use these devices for varying amounts of time and for multiple purposes, while supporting users as they develop skillsets that increase their technology literacies. These many differences have an effect on the way students use digital technologies for learning both at home and at school and often, there are differences in the skills that students are reinforcing with their use in the two locations. With the increasing number of government entities, policy makers, school districts, and financial stakeholders across the country focusing on using technology to increase achievement, it is critical that we take steps to understand if and how much teachers are using the technologies they have access to in their classrooms. This disparity may be causing students in middle and lower SES classes to fall behind students in higher SES classes.

Recommendations

There is a need for more studies to be conducted on the ways girls and boys at the elementary level use technology. A majority of the research that was found addressed students from pre-adolescence to adulthood. Longitudinal studies that follow participants as they matriculate through grade school would be beneficial for monitoring how maturation and education affect technology usage. Research needs to be conducted on whether male and female technology usage is influenced more by biological makeup or gender stereotypes and socio-cultural norms. This data will help educators be more conscious of the conversations and interactions they have with students so they provide relevant and effective learning

opportunities without gender bias. There should also be studies to explore how Gurung and Rutledge's "overlapping" between these home and school engagement with technology could facilitate or block student engagement during learning.

Teachers should continue to create learning environments that are conducive to the ways both males and females work with technology and provide learning activities that would engage all students. It is important for educators to be mindful that although students have the same amount of access, they may not be getting to use computers for equivalent amounts of time or in ways that interest them. Classroom teachers could group students differently for collaborative assignments and create roles with specific duties for students to assume during group projects. This would give students the opportunity to work with others in new and insightful ways by having students try roles they traditionally would not select on their own.

Teachers and curriculum designers need to continue to integrate ICT resources into the curriculum and develop instruction that provide students with opportunities to expand their technical skills. Since students enter classrooms at different levels of ICT capability, teachers will have to refrain from assuming what skills students do or do not have when planning for technology integration. With a proper support system in place, schools could provide students with opportunities to engage in activities to develop ICT literacies like extracurricular after-school programs or electives that address their digital interest and match up with curriculum standards that educators are required to teach. Then students would be engaged and gaining skills while progressing toward meeting or exceeding standards.

Teachers could include more learning activities that don't focus solely on teaching how to use software, but provide students with situated tasks and problems that incorporate

the skill sets that they want them to develop. It would also be advantageous to promote students using the various digital technologies that they have access to at home to create artifacts to demonstrate their knowledge of subject matter. Schools should invest in more professional development for teachers on integrating ICT resources in the curriculum and the ongoing support necessary to sustain an initiative within a school. Research confirmed that providing sufficient PD opportunities increased teacher confidence with using ICT in their classrooms.

Teachers and parents must make an effort to provide adequate support to both male and female students as they use technologies for learning, communicating, and entertaining themselves. Since girls prefer to play games that involve social interaction and open-ended challenges, and boys prefer games are competitive and action-oriented, teachers should continue to look for activities that incorporate these components. Creating learning situations that incorporate real-world application to these games and simulations will engage both genders in an interactive and entertaining learning process. Some students are learning about social media in schools but more resources should be provided for parents who want to know more about how to teach their teens age-appropriate decision-making skills for technology use and provide their children with safe ways to use digital technologies.

Educators should use data to find areas for targeted ICT integration in curriculum planning. For example, middle school students were not proficient in constructing and demonstrating knowledge, which is an essential skill in both academic and professional circumstances. Schools are increasingly asking students to demonstrate their knowledge and skill via digital technology. (Ritzhaupt et al., 2013). Instructional design for human computer

interaction should take socioeconomic factors like the race, income, and education of its users into consideration when creating learning materials for diverse populations.

With so many schools pursuing 1:1 initiatives, administrators and educators should consciously evaluate their curriculum to see whether or not it includes beneficial technology integration. If the curriculum does not, they should see how they can improve it to make integration more effective. Administrators must continue to build and be support systems for teachers who are creating an environment that is conducive to learning for all students. Both administrators and policy makers have to be knowledgeable on this topic so they do not create policies that restrict students' access to beneficial technologies or inhibit the ways students can productively use them.

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