Gaming and Early Learners

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Introduction

As technology has become more personalized and portable, its integration into the early learning curriculum has attracted an increasing amount of public attention (Wartella et al., 2013). Since the 1980's, research studies have explored the usefulness of technology as a learning tool for early learners from birth to kindergarten entry. Some educational researchers have suggested that game-based learning is an effective application of play-based technology in the early learning classroom. In the second installment of the *Early Learners and Digital Learning* series, this informational brief explores game-based learning and its effect on early learners' development and learning. The report first briefly examines play-based technology, identifies what digital game-based learning is and its connection to play based technology. The brief then analyzes the benefits and challenges of game-based learning. The benefits include increased motivation to learn, while the challenges include teachers' inability to integrate game-based learning into the curriculum. Finally, the informational brief addresses recommended solutions to the identified challenges. Through an examination and analysis of game-based learning and its effects on early learners' development, the research illustrates that for the benefits of electronic play to be maximized, it should be utilized as a supplement instead of as a replacement for traditional teaching practices. Moreover, in order to successfully integrate digital gaming into a curriculum, educators need to receive sufficient training, of which there is currently a shortage.

What is Play-Based Technology and Digital Game-Based Learning?

Play-Based Technology

In their joint statement on classroom technology, the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College (2012) included the following devices as interactive classroom technology: touchscreen devices, interactive whiteboards, personal computers, and tablet computers. But what exactly is "play," and how is it connected to these specific technologies? Downey et al. (2007) describe play as activities that are engaging and help children in their social and cognitive development. Interactive classroom technology, as referenced by NAEYC and the Fred Rogers Center for Early Learning, can be considered "play-based technology" because they allow young learners to benefit from play much like traditional dramatic play and board games (Kernan, 2007; McManis & Gunnewig, 2012; NAEYC & Fred Rogers Center, 2012). While traditional forms of play include dramatic play and board games, which help stretch children's imagination, play-based technology has been shown to improve social and cognitive development (Kernan, 2007). Play based technology is not only engaging and developmentally beneficial for kids, but it serves as a platform for digital gaming (Kernan, 2007; Prensky 2006).

Digital Game-Based Learning

Games used as educational tools, are referred to as "digital game-based learning" (Prensky, 2006). The Joint Information Systems Committee (JISC) (2007) states that game-based learning is various software applications that utilize games for learning or educational purposes. Game-based learning is a great way to integrate educational technology into the early learning curriculum (McManis & Gunnewig, 2012). However, many teachers are unsure of how to identify educationally appropriate games and how to properly implement them as a learning tool (McManis & Gunnewig, 2012; Wartella et al., 2013). These challenges are just a few that detract from the benefits of game-based learning.

Benefits of Gaming-Based Learning for Early Learners

More children today are identified visual thinkers perhaps due to increased exposure to television, computers, cameras, video games, and touchscreen devices from a young age. Prensky (2006) states that children's ability to process information is influenced by graphics, making it easier for them to associate speech and text with visual illustrations. With more early learners cognitively developing as visual thinkers it is viable to assume that digital games would reap benefits to their learning experiences and overall development.

Prensky (2006) argues that computer gameplay motivates children to learn because their familiarity with graphics makes it a fun, yet still structured, way to learn. To support Prensky's claim, a compiled review of past empirical studies by McCarrick and Li (2007) provides evidence that educational software augments several benefits which include early learners' motivation to learn. Moreover, the research suggests that electronic play also enhances their social development and cognitive development.

Motivation to Learn

One study that explored digital gaming's effects on motivation was conducted by Hyson (as cited in McCarrick & Li, 2007). In Hyson's study, the facial expressions of sixteen preschool children were videotaped while they played a computer game that engaged them in several activities: drawing, "face construction", and counting (McCarrick & Li, 2007). Hyson claimed that the children's facial expressions were directly correlated with their motivation to learn: a positive expression translated to greater motivation while a negative expression translated to less motivation (as cited McCarrick & Li, 2007). The sixteen preschool children's facial expressions were positive throughout, which, according to Hyson (as cited in McCarrick & Li, 2007), meant that they had a great motivation to learn. Hyson's study (as cited in McCarrick & Li, 2007) demonstrates that the digital program was actively engaging, thereby providing a source of motivation for children to learn. A similar study was conducted in 1996 by Liu (as cited McCarrick & Li, 2007).

Liu (as cited McCarrick & Li, 2007) conducted a study on the correlation between facial expressions and children's motivation to learn. Twelve preschool children were monitored as they

played with a "Jungle Book" computer-learning program (as cited McCarrick & Li, 2007). Liu (as cited in McCarrick & Li, 2007) observed that although ten children were familiar with the program, only nine exhibited positive emotions while playing. However, the study proved to demonstrate that play increases a motivation to learn due to the majority of the children's request to play with the game again (as cited in McCarrick & Li, 2007). Hyson's and Liu's studies (as cited in MCCarrick & Li, 2007) demonstrate that game-based learning encourages children to learn and motivates them to continue learning.

Social Development

Muller and Perlmutter (as cited in McCarrick & Li, 2007), monitored the social interactions of twenty-seven children between the ages of three and five while they experienced two different forms of play: computer games and regular classroom puzzles (as cited McCarrick & Li, 2007). Muller and Perlmutter (as cited in McCarrick & Li, 2007) reported that 63% of computer play involved peer-to-peer interactions while only 7% of traditional puzzle play involved peer-to-peer interactions. In a similar study, Shahrimin and Butterworth (as cited in McCarrick & Li, 2007) observed six 5-year-old children. While playing with a computer, the children exhibited collaborative behavior (as cited McCarrick & Li, 2007).

The data from these studies suggest that when early learners play computer games in groups, they actively interact with their peers. There has been concern that the passive nature of computer gameplay promotes anti-social behavior, however the reports mentioned here contradict that concern (NAEYC & Fred Roger Center, 2012). In fact, the observations suggest the opposite: that computer games benefit early learners by promoting collaboration and relationship building.

Cognitive Development Through Independent Technology Use

When discussing children's cognitive development through gaming, McCarrick and Li (2007) refer to two different theories of human cognitive development: Piagetian Theory and Vygotskian theory. Piagetian Theory, developed by Swiss psychologist Jean Piaget (1896-1980), states that people develop their cognitive ability through direct and active interactions with the world around them. One of Piaget's former students, Seymour Papert, believed that computers could encourage children to learn through active exploration (as cited McCarrick & Li, 2007). Computer play involves plenty of individual decision-making: what to click on the screen, what to type into the computer, and when to ask for help from peers (as cited McCarrick & Li, 2007). Moreover, computer games can encourage independent thinking, which in turn enhances cognitive development through discovery (the nature of Piagetian Theory). The following study provides support for this reasoning.

Haugland (as cited in McCarrick & Li, 2007) observed 49 preschool children across four classrooms. Two classrooms utilized computers that had developmentally appropriate software that was interactive and actively engaging, while one classroom employed non-interactive software with its computers. The final classroom examined did not use computers at all (as cited in McCarrick & Li, 2007).

The two classrooms that used the engaging software made the greatest strides in cognitive development, while the two classrooms, which lacked engaging software, demonstrated little or no cognitive improvement (as cited in McCarrick & Li, 2007). These results suggest that early learners can develop their cognitive abilities by independently playing educational computer games. Therefore, the nature of Piagetian Theory can be observed by integrating computer gameplay as a part of the early learning curriculum and supports the argument that game-based learning on an individual level benefits early learners.

Cognitive Development Through Teacher-Mediated Technology Use

Lev Vygotsky (1896-1934), formulated his own theory of cognitive development that states people learn by completing structured activities that are designed by older, more knowledgeable peers. Vygotskian Theory also lends support to the sentiment that game-based learning can also take a more group-oriented approach. Several studies are examined to support Vygotsky's claim and demonstrate that early learner's cognitive development is positively impacted by game-based learning through instructor mediated activities.

The effectiveness of instructor mediated game-based learning is captured by two studies. Primavera et al. (as cited in McCarrick & Li, 2007) conducted a study on 212 preschool children over an entire school year to identify how children benefit from instructor mediated game-based learning. Children who received assistance from a teacher while playing with computer software showed greater improvement than children who did not receive assistance from a teacher. In a separate study, Shute and Miksad (as cited in McCarrick & Li, 2007) observed that instructional scaffolding with computers led to higher scores on tests that measured cognitive development. McManis and Gunnewig (2012) support this claim.

To achieve learning goals and reap positive benefits of game-based technology, McManis and Gunnewig (2012) recommend instructional scaffolding. Instructional scaffolding is characterized by educational support that is tailored to the individual needs and weaknesses of students (as cited in McCarrick & Li, 2007). This type of instruction can take place while early learners are playing with electronic devices (as cited in McManis & Gunnewig, 2012). McManis and Gunnewig (2012) explain that when a teacher works alongside a child, the teacher is able to provide immediate feedback, instructions, and problem-solving strategies. This serves to help the student achieve the learning goals of the computer game because if a student experiences difficulty, the teacher can help him or her think through the problem (McManis & Gunnewig, 2012). In addition, the instructor can ensure that the child does not become discouraged, which would otherwise diminish the cognitive improvement that can be made (McManis & Gunnewig, 2012).

To summarize, Vygotskian Theory supports the notion that cognitive development can occur when learning becomes a collaborative task between instructor and pupil. The studies cited by McCarrick and Li (2007) and the research by McManis and Gunnewig (2012) provide evidence that instructional scaffolding is an appropriate method by which early learners can experience such development.

Summary of Benefits

Motivation is engendered by game-based learning, which increases the likelihood of intellectual progress because children are willing to use it as a learning tool. Also, there are two major theories that posit different ways in which human cognitive development takes place: Piagetian Theory and Vygotskian Theory. The former supports the belief that learning takes place through curiosity and independent discovery while the latter emphasizes a more social approach that involves instructors and mentors. Research has shown that early learners can benefit when they use technology on their own because interactive software enables exploration, thereby augmenting cognitive development in the way that Piaget theorized. In addition, when early learners play digital games along with their teachers, they make evident progress in the fashion that Vygotsky imagines.

The Challenges of Game-Based Learning

The Appropriate Educational Value of Games

While electronic play has its benefits, there are also some challenges that pose disadvantages to utilizing educational games. Companies that design educational games are motivated by profits instead of supplementing the education of millions of early learners, which reduces the educational value of games. Singer (2013) examines the "profit before quality" mentality of two companies who have produced infant educational games.

Fisher-Price and Open Solutions are two companies that have marketed their "baby learning apps" as tools to teach infants spatial skills, numbers, language, or fine motor skills (Singer, 2013). However, both companies "baby learning apps" were found to not achieve the following objectives. Similarly, the Walt Disney Company claimed their "baby learning apps", which include "Baby Einstein" and "Your Baby Can Read", could teach children less than a year old to read. However, the Walt Disney Company tools were found to not fulfill its claim, which caused the company to settle charges for false advertising and agree to offer refunds to families that purchased the apps (Singer, 2013).
Digital games in the market, that lack educational value, pose potential developmental issues for children who engage with them due to their entertainment value. Companies whose motive is to create digital games, without educational value and market them as such, to gain large profits inhibit the potential cognitive and social development from these technologies. Additionally, companies like Fisher-Price and The Walt Disney Company, that have earned large profits based off their reputation of producing quality child appropriate products for decades, cause misinformed parents to select developmentally inappropriate games for early learners. Early childhood education, who are not adequately trained to identify developmentally appropriate games for their students, have also been subjected to false advertising from companies, which is a barrier to the benefits of early learners engagement with digital games in the classroom.

Educator Training and Professional Development

Teachers are able to use gaming platforms on an individual basis, but unfortunately they do not have adequate training to appropriately use or identify developmentally appropriate platforms. The NAEYC states that majority of teachers do not receive sufficient training to successfully apply game-based learning to the school curriculum. Teachers' inability to identify and properly use game-based technology limit the tools ability to motivate, socially integrate, and intellectually develop early learners (Prensky, 2006; McManis & Gunnewig, 2012). Teachers often use technology to replace traditional teaching practices instead of using it as supplement, which encourages passive and inappropriate use by early learners. McManis and Gunnewig (2012) state that technology must be collaborated with a human component to exemplify the education in educational technology. If using digital gaming early childhood educators must implement a curriculum that includes traditional teaching practices and the use of game-based technology.

Possible Recommendations

Although existing challenges exist in digital game-based learning, there are several recommendations that can be offered to diminish those challenges.

To identify the educational value of game-based technology, teachers should utilize cases studies and conduct research on game-based technology before implementing the tools into the curriculum. However, teachers must receive adequate training on how to identify what is developmentally appropriate and what is not.

To combat early childhood educator's improper use of digital game-based technology and increase their ability to identify developmentally appropriate tools, McManis and Gunnewig (2012) propose two solutions: built in supports and learning communities. Built in supports provide tutorials, sample lessons, sample activities for students, and help functions in software programs (McManis & Gunnewig, 2012). Early childhood educators' use of play-based software would make technology integration easier and assist in appropriate use of the software.

According to McManis and Gunnewig (2012) learning communities bring educators together and promote an exchange of active learning from the members of the community opposed to an expert (McManis & Gunnewig, 2012). Through group-based learning educators could become more knowledgeable about play-based technology and more informed on how to use and identify developmentally appropriate tools. To successfully implement the learning community model, McManis and Gunnewig (2012) provide three ways learning communities can occur: regular gatherings where educators meet in small groups to talk about what they want to learn in regard to educational technology, assembling curriculum development teams to develop lessons on integrating technology in the curriculum, and experienced teachers serving as mentors for inexperienced teachers (McManis & Gunnewig, 2012).

The suggestions made by these authors are possible solutions to closing the integration knowledge gap, which could potentially diminish challenges and enhance the benefits of game-based learning.

Conclusion

This brief first establishes the supplementary relationship between play-based technology and digital game-based learning. The nature of play-based technology is interactive which encourages independent learning (McCarrick & Li, 2007; NAEYC & Fred Rogers Center, 2012). The devices serve as platforms for electronic games, which provide a structured form of play with clear learning goals, much like dramatic play and board games (Kernan, 2007; Prensky 2006).

Some of the benefits and challenges of making electronic play a component of the early learning curriculum were analyzed in this brief. One of the challenges discussed in this brief is the influx of software programs in the market that do not have enough educational value. However, reading reviews and case studies of games before using them can solve this problem. Finally, educators need more training in order to effectively integrate game-based learning into the early learning curriculum. As McManis and Gunnewig recommend, learning communities and built-in program supports are possible solutions to this problem.

Despite these challenges, numerous studies have shown that early learners make social and cognitive improvements and show a greater motivation to learn when they play with computer games. While computer-based learning has been shown to encourage development through independent thinking, teacher-mediated lessons lead to the greatest improvement (McManis & Gunnewig, 2012). Therefore, digital gaming is more promising as a supplemental component to instructional scaffolding rather than as a replacement for traditional instruction.

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