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Training Teachers in Digital Literacy

Children as Digital Natives: Implications for Visual Spatial Functioning Skills and Teacher Preparedness

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Abstract

Children are digital natives who have never known life without technology, while many teachers never experienced digital environments as young learners in the classroom and lack a personal reference point to look back on when teaching. Findings related to visual spatial functioning and young smart device users show a relationship between the two that carries over to the classroom setting. Techniques are available to improve training related to technology and pedagogical learning by looking at the teacher's own cognitive attributes, professional factors, and personal characteristics. The Science of Learning approach facilitates the teacher's ability to recognize and incorporate quality educational technology into the classroom setting. Understanding factors of digital competence will lead to greater success in the classroom setting.

Keywords:
Educational research
Visual spatial functioning
Integrated technology

1 Introduction

Children are learning to navigate the internet before they can read. Preschoolers appear to have a natural affinity to be able to use smart devices, and the majority of children in the U.S. have access to touch-screen devices. Many other countries have also shown an increase in digital usage. The iPad was released in 2010 and a digital explosion occurred soon thereafter. So many changes have come about in only 8 years, and it is impossible to keep up with ever increasing digital advances. The technological advances greatly impact the schooling of children, both from the perspective of the skills of the student as well as for teacher training. Therefore, this article addressed one difficulty that was found to be associated with smart device usage for pre-schoolers related to visual spatial functioning, and how to compensate in the classroom setting. Ways to improve teacher preparedness are also explored related to information and communication technology. Lastly, assessment strategies drawn from the Science of Learning are used to ensure that educational technological programs encompass key points needed for quality teaching materials.

2 Children and Visual Spatial Functioning

The children of today are boldly going where no youngster has gone before, as they have never known a life without mobile devices, computers and television. Young children are digital natives, with many parents commenting on the almost instinctual way they are drawn to mobile technology and able to easily maneuver through applications (apps). Numerous apps have been developed for preschoolers, and educational programs are promoted as a means of facilitating learning. Touch screen technology can be found in homes as well as preschool settings, and the top grossing apps for young children downloaded on the iTunes website are advertised as "Education" (http://itunes.apple.com/). Yet studies have not yet been conducted on the validity of

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the educational potential. Parents often emphasize the educational benefit of digital usage (Verenikina & Kervin, 2011), which may create a positive halo effect. The belief of a positive educational impact results in parents having an overall optimistic view of their child using integrated technology, even without the research to back up these beliefs. This led to my studies focusing on digital media and visual spatial performance (Keefe-Cooperman, 2016a) and strategies for the classroom setting (Keefe-Cooperman, 2016b).

2.1 Digital Media and Visual Spatial Performance Findings

Preschoolers from a 2010 study (612 children) were compared to preschoolers from a 2014 study (492 children) because of the digital explosion into everyday life that occurred between the two time periods. Television viewing patterns have remained similar over time, but technological device usage has increased. The 2014 group watched about the same amount of television, and had additional screen time through digital usage. The 2014 preschooler group had higher daily total screen time amounts as a result. Additionally, on average, children who were reported to watch greater amounts of television had higher amounts of technology usage.

Preschoolers who were identified as white by their parents had less statistically significant digital device time usage than self-identified black participants, but not Latino(a) or Asian participants. Parents in the "at risk" income level reported statistically significant greater amounts of digital device time usage than those in the lower middle class, middle class, and upper middle class. Historically disadvantaged and poorer children are spending more time on digital devices. Maternal education was also related to digital media usage based on differences between group means, but no clear pattern was found.

Greater daily digital usage was associated with lower visual spatial performance as seen in Table 1. Table 2 shows how spending even small amounts of time daily with integrated technology was associated with lower WPPSI-IV overall intelligence test scores, and visual spatial scores. Those with the least amount of resources are at the most risk for lower visual spatial abilities.

2.2 Tables

	1	2	3	4
1. WPPSI-IV Visual Spatial	--	-.10*	.27	--
2. Smart Device Usage		--	-.06	-.20*
3. PDMS-2 FMQ			--	--
4. WPPSI-IV Full Scale IQ				--

* p < .05

Table 1: Bivariate Correlations Among WPPSI-IV Visual Spatial Composite Index, Smart Device Usage Time, and PDMS-2 Fine Motor Quotient (Keefe-Cooperman, 2016)

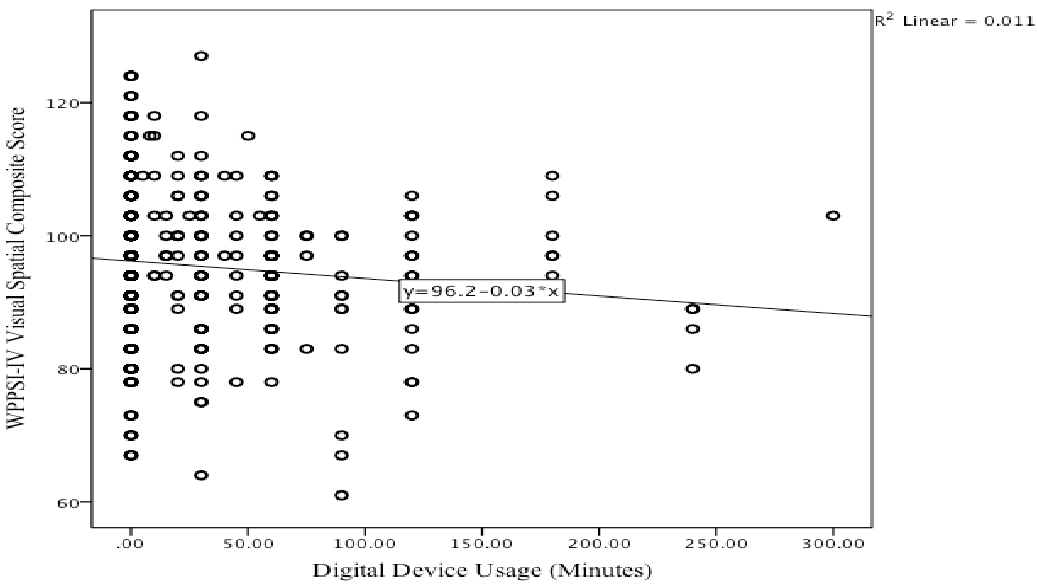

Table 2: Smart Device Hours and WPPSI-IV Visual Spatial Scores

Note: The negative correlation between the WPPSI-IV VSI (Visual-Spatial Index) and digital device time usage is uniform throughout. There is no threshold level whereby digital device time usage is associated with lower WPPSI-IV VSI. Any digital device usage was associated with lower WPPSI-IV VSI scores.

2.3 Implications for Practice in the Classroom Setting

There are several implications for practice which emerged from the results of the study. The first is that parents from lower SES backgrounds, having less maternal education, or from a historically disadvantaged racial/ethnic identity need to be informed about integrated technology and visual spatial functioning. This could be done via fact sheets sent home to parents or at a specific parent training session. Parents have the best interest of their children at heart, and are open to making changes in the home as a result.

The second is that including more fine motor and visual spatial play activities into the ongoing curriculum may improve overall abilities and lead to greater STEM success in later grades. Classroom settings in the earlier grades typically contain several play areas where children can go to play with blocks, Legos or other three dimensional building toys. Integrating spatial education as more of a key part of the curriculum will result in gains in the STEM related fields (Verdine et al., 2014). Implementing a spatial education as part of the ongoing daily curriculum will also identify at risk children and improve overall abilities. A way to successfully achieve spatial education is to move blocks, puzzles and shapes from free-play activity areas into the curriculum. The classroom setting can be a place of equalization that brings all children to the same level of competence.

There is no turning back time on the use of technology. What can be done is to increase the ability of the teacher to recognize the differing factors that influence the impact of digital usage on children and appropriately use technology to enhance the learning experience. However, an important component is the teacher's openness to digital technology in the classroom, level of expertise with technology, and ability to apply critical thinking strategies to evaluating the appropriateness of digital programs.

3 Teacher Training in Information/Digital Technology

Many teachers are in unknown territory related to technology and childhood. The digital explosion of 2010 resulted in children coming into the classroom as technological natives. Adults often use their own childhood memories as a reference point for understanding the world of youngsters. However, most current teachers did not have the same level of digital immersion as is present now. There is a lack of a reference point to use as a model, which results in ambiguity as to how to best handle technological usage (Plowman, McPake & Stephen, 2010). This can cause a disconnect that impacts the teacher's willingness or ability to integrate technology in the classroom setting, as well as their ability to recognize the strengths and weaknesses current students have based on their level of smart device usage.

Many benefits are cited in relation to increased access to technology. Chiong and Schuler (2010) note that mobile learning provides a venue for underserved children to be able to access educational material, and that teachable moments can now occur anytime and anyplace. Apps have also been integrated into special education therapies. Bouvat, Kangas and Szczech Moser (2014) cite the positive aspects of apps related to helping youngsters with special needs, and increasing academic learning. The benefits are also present in the classroom setting.

One way to maximize the success is to train teachers in the area of information and communication technology (ICT) (Kounenou, Roussos, Yotsidi & Tountopoulou, 2015). This involves the differentiation of attitudes towards ICT in general and as an educational tool for the classroom setting. Three points are key for success.

1. Cognitive Attributes: This examines how the teacher viewed their own competence and self-efficacy related to ICT use, as well as their attitudes and beliefs about technology as a whole.
2. Professional Factors: Determining the beliefs teachers hold about ICT in the field of education and their professional skill set to successfully integrate the most current technological tools in the classroom.
3. Personal Characteristics: This involves the teacher's openness to change, positive attitudes towards technological skills, and general as well as technological innovativeness.

Using ICT for teacher training programs will result in greater teacher efficacy for multiple reasons. Teachers who may not have been the most technologically savvy will recognize this relative weakness within themselves and determine how to work towards developing greater competence. The professional skill set of a teacher needs to include digital prowess. The ICT approach helps to emphasize the importance of technology. Those trainees who already have a higher level skill set and openness to integration of ICT in the classroom will be validated and achieve a greater sense of self-efficacy. Teachers are key players in making the digital world a successful place for children to learn and grow.

4 Teaching Teachers to Assess the Quality of Educational Apps/Materials Using the Science of Learning

The child has always been an active participant in their own developmental progress, and theorists have long identified the importance of fine motor functioning for preschooler growth. However, the preschooler's interaction with the larger world has changed with the advent of technology. Piaget (1952) attributed sensorimotor skills as being key for early cognitive development in children. The infant actively explores their environment through the use of motor skills, and this forms the base for their knowledge of the world. Socialization and exploration opportunities within the home or larger environment have historically been the proving ground for a youngster to test out new behaviors and ideas. The use of technology changes how the child uses their visual and spatial skills. Care must be taken to ensure that technology in education enhances learning. Teachers in training can be taught to recognize quality educational technological programs from the Science of Learning by examining different aspects as related to child involvement. Three kinds of engagement include active learning; engagement in the learning process; and meaningful learning (Hirsh-Pasek et al., 2015).

4.1 Active Learning

Children play an active role in their own learning and are active knowledge builders. A youngster does not simply sit idly by but participates and integrates new information into their existing cognitive world. Good educational technology uses symbolic material to support active cognition. Various levels of mastery and expertise help to keep the child actively involved and interested.

4.2 Engagement in the Learning Process

There are three kinds of engagement involved using the Science of Learning related to engagement. The first involves *behavioral engagement*. This focuses on following the rules. Effort, persistence and the level of participation in the program are key. The child must evidence a level of effort and perseverance. The second form of engagement is *emotional engagement*. The youngster need to have an affective reaction to what is going on and not just sit idly by in a detached emotional state. The third area is *cognitive engagement.* There needs to be an investment in the learning process. Cognitive flexibility is needed for problem solving. In practice, the teacher can ensure that the child receives positive feedback for the effort that is put forth within the program itself. There also needs to be a goal that the child is working towards that is achievable.

4.3 Meaningful Learning

The last area related to the Science of Learning involves meaningfulness. Experiences that connect to our existing knowledge in a sustainable and useful manner are key for success. This can refer to common childhood experiences being reflected in a technological tool, such as a panda bear in a story having to find their crayons to put back in the box. Most children relate to having to put away their possessions when done, or at least being told to do so on occasion. A panda bear in an educational online program might have to count the crayons while putting them back in the box and help the child master basic math while still connecting to daily life. The number and quality of the relationships that can be established between the technological instruction and larger world of the child strengthens the efficacy of the learning tool.

4.4 The Science of Learning and Instructional Technology

Training teachers to critically assess the efficacy of digital technology in the classroom setting will enhance the learning potential for students. Hirsh-Pasek et al. (2015) had been primarily focusing on educational apps.

However, the Science of Learning approach is quite appropriate in the classroom setting and can be extended into teacher training. Integrating the critical thinking skills inherently imbedded in this approach will improve the teacher's ability to recognize and incorporate quality educational technology into the classroom setting.

5 Discussion

The majority of children enter the academic classroom with previous exposure to the digital world, and there are strengths that can result from usage. Children may know their alphabet better or master numbers more easily because of playing with educational apps. There can also be negative effects that can occur from engagement in the two dimensional and isolative world of technology. We focused on how the use of smart devices has been related to lower visual spatial functioning in younger children, and especially those coming from at risk backgrounds. Understanding that there are downsides to technology prepares educators to provide compensatory teaching strategies, such as Legos in the classroom or other forms of play aimed at improving visual spatial functioning. This is quite an important skill that must be developed due to its link to later STEAM success. Additionally, teacher preparation programs can easily incorporate curriculum to enhance trainee willingness to bring quality technological learning methods in the classroom, and to arm the future teachers with critical thinking strategies for determining the strength and appropriateness of digital teaching tools. Digital content will continue to grow exponentially. Recognizing and incorporating higher-quality digital learning will enhance academic mastery for children.

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