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Program Evaluation: Integration of Educational Software into the Elementary School Math Curriculum

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Abstract

At the research site, which was one elementary school within a public school district, teachers used educational software to help their students increase proficiency in math. The purpose of this program evaluation case study was to examine the perceptions of teachers of the integration of math software into the curriculum. The conceptual framework was based on the social learning theory. Purposive sampling was used to select teachers to participate in face-to-face semi structured audio taped interviews. Data were collected from 6 elementary school teachers who taught math and used educational math software in their classrooms. Data were analyzed using line-by-line thematic analysis for emergent themes. The findings indicated strategies teachers used to integrate software into the math curriculum to enhance learning via small group instruction. These findings can be used by school and district administrators regarding professional development opportunities for teachers on using successful strategies to integrate educational software into the math curriculum.

Keywords: *computer assisted instruction, elementary school math and academic resources, integration of math software into the curriculum, math instructional strategies, understanding math by using technology, state scores in math, and math software, and elementary school testing in math.*

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Introduction

At the research site, which was one elementary school within a public school district, math teachers used software to help students improve their proficiency in math as measured by state tests. Math educational software programs, such as Success Maker, were integrated into the curriculum to help students better understand math concepts.

Software programs are used as educational tools in the classroom. Integration of software programs into the curriculum is essential to improving student achievement (Chamberlin, 2010; Crosnoe et al., 2010; Ertmer & Ottenbreit-Leftwich, 2010; Liu & Szabo, 2009). Software may include audio, video, animations, text, and graphics. When educational software programs are aligned with curriculum, the outcome is (a) improved student achievement (Van Steenbrugge, Valcke, & Desoete, 2010) and (b) students develop educational skills (Allsopp, McHatton, & Farmer, 2011). Educational software programs could be challenging for educators who may need job-embedded training on how to effectively integrate software into the curriculum (Crosnoe et al., 2010; Goktas, Yildirim, & Yildirim, 2009; Lim, Lee, & Hung, 2009). Teachers may have negative perceptions of software integration into the curriculum (House, 2009; Li & Ma, 2010). Teachers could be using software programs periodically (McKinney, Chappell, Berry, & Hickman, 2009); however, math-related software programs are designed for students to develop math skills (McKinney et al., 2009).

Problem Statement

At the research site, students were not meeting academic standards as measured by state tests. School district administrators piloted a program where educational math software such as Success Maker was integrated into the curriculum in all elementary schools to help students improve their proficiency in math. District administrators had no research-based findings regarding the software integration into the math curriculum at the research site in order to make district-wide decisions on the permanent integration of educational software in the elementary school curricula. No pilot program had been implemented as a permanent solution.

Research Question

The research question that guided this study was regarding the perceptions of elementary school teachers of the integration of educational software programs into the math curriculum with the focus on students'

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proficiency in math. The goal of this research question was to understand how the pilot math software program was perceived by math teachers who integrated the software into the curriculum.

Conceptual Framework

The conceptual framework was based on the social learning theory, which posits that individuals learn from one another through collaboration, personal interactions in society, and instruction. This theory applies to math teachers who engage students in problem-solving activities by using software in the classroom to reach a shared goal, which is proficiency in math and to help every student as a member of a class team. Learning through social interaction leads to cognitive growth and knowledge acquisition (Bandura, 1989). For example, students who use math software, use prior knowledge of math concepts to construct new knowledge in math.

Assumptions, Limitations, Delimitations, and Scope

Assumptions: (a) the participants provided honest responses during the interviews and member checking and (b) used math software in the classroom. Limitations included: (a) interview data, (b) research design, (c) small sample, (d) the depth of the participants' responses, and (e) the findings may not be applicable to math teachers in different contexts. The scope of this case study was that the participants were from one school within a school district. Delimitations: (a) this study was bounded by one elementary school at the research site where math software programs were integrated into the curriculum, and (b) qualitative data were collected.

Literature Review

Educational software has been used in the classrooms (Looi & Lim, 2009). Software is an education tool, which can be used to help students learn math concepts (Olkun, Altun, & Deryakulu, 2009). Educational software may include text, animations, video, and graphics. Graphing software improves students' (a) understanding of algebraic concepts (Lagrange & Erdogan, 2009; Ruthven, Deaney, & Hennessy, 2009) and (b) motivation and engagement. Integration of software programs into math instruction could enhance instruction (Allsopp et al., 2011; Ertmer & Ottenbreit-Leftwich, 2010) for teachers to transmit knowledge (Dakers, Dow, McNamee, 2009) to help students think critically (Almekhlafi & Almeqdadi, 2010).

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Software programs might not be integrated to support best teaching practices instruction (Ertmer & Ottenbreit-Leftwich, 2010) when teachers have (a) limited accessibility to software (Wachira & Keengwe, 2011), (b) limited experiences with the use of software (Almekhlafi & Almeqdadi, 2010), (c) inadequate professional development on software (Hartsell, Herron, Fang, & Rathod, 2009; Lagrange & Erdogan, 2009; Schonfeld, 2011), and (d) different perceptions of the use of software in the classrooms (Guzman & Nussbaum, 2009). Barriers to integrating software into the math curriculum have been well-documented (Bellamy & Mativo, 2010; Chamberlin, 2010; Wilcox & Monroe, 2011).

Software programs should be used in the classroom to assist students in understanding math and in developing higher-order thinking skills (Chamberlin, 2010) by (a) addressing specific students' needs (Van Steenbrugge et al., 2010) and (b) using practical real-world examples and applications (Bellamy & Mativo, 2010; Schoenfeld, 2011). Real-world inquiry-based learning helps students construct meaning (Thomas & Ye Yoon, 2013). Teachers should teach higher order thinking and math skills (Crosnoe et al., 2010). Use of math software depends upon its successful integration (Li & Ma, 2010) with the focus on improving students' learning (Roschelle et al., 2010) of math and developing problem solving skills (Maloy, Edwards, & Anderson, 2010). Technology integration into math improves students' learning (Yang & Tsai, 2010) because students are provided with immediate feedback by software programs (Mendicino, Razzaq, & Heffernan, 2009) and teachers are supported with training (Kotcha, 2012).

Research Design

A program evaluation was used to provide qualitative evidence for recommendations for the improvement of the math software pilot program at the research site regarding the integration of math software into the curriculum. A participant-oriented approach was used to focus on the perceptions of math teachers who integrated math software into the curriculum. The program evaluation was a qualitative case study method to understand the perceptions of elementary school teachers who integrated software into the math curriculum. An interview protocol was used to collect evaluative in nature data to provide evidence of the influence of the math software program on the perceptions of math teachers.

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Population, Sample, Selection Criteria

The elementary school had approximately 998 Grades 1-6 students. The characteristic of the student population was: 85% African American, 11% Latinos, and 2% White. The study population was 22 teachers. Purposive sampling was used to select teachers from the research site. The participant selection criteria included: (a) state certified teachers, (b) teachers employed at the research site for at least 3 years, (c) teachers who integrated math software into the curriculum, and (d) teachers who signed a consent form agreeing to participate in the study. All participants meeting the criteria for the study were invited to participate in the study. The sample was six (n = 6) teachers.

Data Collection, Instrumentation, and Data Analysis

All interviews were conducted in a private conference room at the school using the interview protocol. Each semi structured face-to-face audio taped interview lasted approximately 60 minutes. The interview questions were open-ended. Each audio taped interview was transcribed within 5 days. The interview transcripts were analysed using qualitative thematic analysis and coding for emergent themes. A research log was used to document all communications with the participants. A reflective journal was used to save field notes throughout each semi structured interview. To triangulate the data, interview transcripts, member checking, the research log, and reflective journal were used. Member checking contributed to the credibility of the findings.

Findings

Participant 1 used math software for students to understand difficult concepts. Participant 1 encouraged students to use math software in small groups where the teacher was the facilitator. Participant 2 used different teaching strategies to teach math by using both software and textbooks. Participant 3 used math software to help students understand abstract math concepts through animations. Participant 4 used math software for students to solve problems using small group instruction with the role of the teacher being that of a facilitator. Participant 6 used both math software and Socratic teaching methods for students to better understand difficult math concepts.

Participants 1, 2, 5 and 6 stated that because of the integration of math software into the curriculum, students were active learners and more interested in learning math concepts. Participants 2, 4, and 5 stated that with

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the integration of math software into the curriculum, students demonstrated more responsibility for their own learning. Participants 3, 5, and 6 stated that students did better on classroom math tests. Participants 2, 4, 5, and 6 stated that students met math standards as measured by software and classroom tests.

All participants (a) used the math software and small group instruction to engage students in understanding difficult math concepts, (b) believed that students enjoyed problem–solving using the math software, and focused on real life math problems using the simulation features of the math software, (c) emphasized that students had access to math-related images, text, animations, video, and graphics to solve problems to increase their proficiency in math, and (d) expressed the need for professional development on interactive math software. All participants integrated math software into the curriculum using traditional teaching and the math software in small groups instruction. All participants believed that the math software, which is designed to meet state standards, helped students understand math concepts.

Discussion

The findings are in line with the findings of Allsopp et al. (2011), Bellamy and Mativo (2010), Chamberlin (2010), Crosnoe et al. (2010), Ertmer and Ottenbreit-Leftwich (2010), Li and Ma (2010), Schonfeld (2011), Van Steenbrugge, Valcke, and Desoete (2010), and Wilcox and Monroe (2011). Patterns were common among all participants' responses. All participants integrated math software into the curriculum and used small group instruction to help students understand math concepts. The use of math software helped students practice math and received instant feedback regarding answers to math questions.

Math teachers need professional development opportunities (PD) on teaching interactive math software programs that use simulators for students to work on real-life scenarios to solve math problems. PD on (a) how to use math software assessments in the classroom could help teachers meet the needs of students, (b) the integration of software into the math curriculum should include interactive educational software based on math standards, and (c) teaching strategies to meet the needs of all students.

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Conclusion

Overall, the math pilot program was perceived by the participants as a useful educational tool that motivated students and provided students with instant feedback. The math software was perceived as a resource helping students improve their proficiency. The findings helped district administrators (a) determine whether the math pilot program was worthy of permanent implementation, and (b) make decisions on the allocation of human and capital resources for the integration of software in the curricula. Based on the findings, the math software pilot program was found to be beneficial to students.

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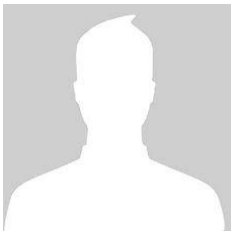
Biodata



Peter KIRIAKIDIS, PhD, has earned a doctorate degree in Educational Leadership in Higher Education. Peter's educational, IT, and research leadership relates to inspiration, direction, clear focus, vision, mission, and excellence. In the past 20 years, his successful administrative, consulting, training, teaching, and IT experience at the university, college, and K-12 levels has been an involved and intense one in a multicultural/diverse environment. Peter has expertise in quantitative, qualitative, and mixed-methods research. As a University Research Reviewer and research faculty, Peter's role is that of a content expert, research methods expert, and editor. Peter has been serving on EdD, PhD, and DBA doctoral committees. As a research reviewer, Peter ensures that a dissertation meets high quality academic standards set forth by the university.

Dr. Kiriakidis has program and project management experiences including the development and evaluation of graduate and undergraduate programs and courses for industry and institutions of education. Peter has conducted research for large school districts related to (a) the evaluation of the effectiveness of professional programs for teachers on student achievement as measured by standardized mandated testing, (b) the development of district-wide policies and procedures based on test scores in science, math, reading, and language arts literacy; and (c) schools and district performance of instructional practices and enhanced curricula. Peter has also conducted research for large graduate colleges and universities related to (a) interactions between online students and instructors, synchronous and asynchronous communication in the online learning environment, (b) the development of policies and procedures for online course delivery, and (c) enhancement of curricula.

Dr. Kiriakidis has expertise in higher education educational leadership: (a) chairing comprehensive examinations and EdD, PhD, DBA, and MA committees; (b) developing and evaluating curriculum and academic programs; and (c) teaching graduate courses in research, educational leadership in higher education, educational and information technology, online technology, e-commerce, software development, and information systems. Peter is a reviewer of many peer-reviewed academic national and international journals. Peter has presented a plethora of research studies nationally and internationally.

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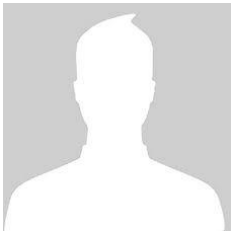

Dr. **Tonya JOHNSON** is the founder and President of Harvard Steps Inc., a not-for-profit therapeutic organization that provide home services to children on the spectrum of autism birth -3 years old. She is also an Assistant Professor at Bronx Community College, Bronx, N.Y. in the Education and Reading Department. Dr. Tonya Johnson began her career in Education as a substitute teacher in the New York City Department of Education. She went on to fully pursue education as her chosen her career. After 5 years of teaching fifth grade, Dr. Johnson became the teacher of Technology for 6 years at her school, and developed a technology curriculum for the school. She has also served as school principal at Merrick Academy Charter School, the first charter school in Queens NY. In both roles, teacher and leadership, she has come to completely understand the importance of building strong networks for children, educators and fostering community partnerships.

Dr. Johnson's professional memberships include ABENY Annual Black Educators of New York, NACCTEP National Association of Community College Teacher Education Programs, CRLA College Reading and Learning Association, ASCD Association for Supervision Curriculum and Development, The Teaching Professor, NEA National Educators Association, and ABCT Association of Behavioral and Cognitive Therapy.

Dr. Johnson serves as a consultant for educators and parents in the area of curriculum development, pedagogy and early childhood; and considers herself an agent of change for underperforming schools and college communities. She combines her love of learning, and her love for helping others create a nurturing community of learners and educators, as a lifelong mission for ensuring a better future for our children.

She holds a doctorate in Teacher Leadership and Administration, Walden University, M.S. in Supervision and Administration, M.S. in Childhood Education, B.S. Business Computer Information Systems, and STEM Certification, New York Institute of Technology.

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