Journal of Contemporary Research in Education

Volume 1
Number 3 *April 2013*

Article 3

4-1-2013

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Journal of Contemporary Research in Education
1(3) 104-113

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Abstract

The present study uses systematic observations to investigate the availability and use of instructional technology in 64 middle school classrooms serving predominantly minority students from economically disadvantaged families. The *T3 Overall Classroom Observation Measure,* a high-inference walk-through instrument, was developed to examine: (a) types and use of technology present in the classroom, (b) teachers' technology usage, (c) students' technology usage, (d) teachers' general instructional behaviors, and (e) students' general behaviors. The results revealed that instructional technology was widely available in the classrooms, but most teachers and students were only using it to "some extent."

Technology in Urban Middle School Classrooms

National reports and current research have found that students in middle level schools are often at greatest risk of academic failure. Characterizing middle schools as "problematic," "mayhem in the middle," and "the forgotten middle," several recent reports have blamed middle schools for the increase of student behavior problems, disengagement from school, and low academic achievement (ACT, 2008; Wilcox & Angells, 2007; Yecke, 2006). One of the critical issues facing middle schools is inequitable access to important educational resources such as instructional technology (Good & McCaslin, 2008). In other words, disadvantaged populations of middle school students have been found to have the least access to instructional technology, which can aid in learning.

There have been a large number of studies that have examined the use of technology in schools (Beers, Paquette, & Warren, 2000; Gray, Thomas, & Lewis, 2010; O'Dwyer, Russell, Bebell, & Seeley, 2008). Most of these studies, however, have been generic in nature and have reported broad findings that are generalized either across the country, a region of the country, or a given state. There have been a few studies that have assessed technology use in particular districts or individual schools, but these studies generally have not examined the extent to which computer technology is integrated into the curriculum and used in middle school classrooms in urban settings (Padrón, Waxman, Lee, Lin, & Michko,2012)

Another concern regarding research on technology use in schools is related to the measurement of "technology use". Most studies assessing technology use have relied on self-report data from administrators or teachers (e.g., McKinney, Chappell, Berry, & Hickman, 2009; Pagni, 1991-92; Vannatta & Fordham, 2004). These types of data are often unreliable and tend to be upwardly biased in the direction of over reporting the actual amount of technology use (Cuban, 2001). Few researchers have actually gone into classrooms to see how teachers and students use technology daily (Cuban, 2001).

There have only been a few studies that have used systematic classroom observations to investigate technology use in schools (Huang & Waxman, 1996; Waxman & Huang, 1995, 1996), but most of these studies have been generic (e.g., generalizing across different content areas and grade levels), rather than focusing on instruction in urban middle school classrooms.

In one of the few studies that have focused on classroom observations of technology use, Waxman and Huang (1995) examined the extent to which computer technology was integrated into the curriculum of 200 elementary and middle school classrooms from a large, urban school district. They found that there was no integration of computer technology in the elementary school classrooms,; while middle school students were observed working with computers in the content areas only 2% of the time. In another observational study, focusing on 1,315 students from 220 middle school mathematics classrooms, Huang and Waxman (1996) found that calculators were the most frequent type of technology used, but they were used only about 25% of the time. During the observations, computers were used less than 1% of the time in mathematics classrooms.

In a more recent study, Padrón, Waxman, Lee, Lin, & Michko (2012) observed technology use in 27 fourth- and fifth-grade classrooms serving Hispanic English Language Learners (ELLs) who came from socially- and economically-disadvantaged circumstances. They found that the use of technology in these classrooms was very limited and that the only instructional practice that was used extensively was direct instruction.

Purpose of the Study

This study focuses on the critical issue of using technology as a tool to enrich classroom practices for urban middle school students. Research has indicated that the use of educational technology as a learning tool can increase student learning (Hattie, 2009; Lei & Zhao, 2007; Lee, Waxman, Wu, Michko, & Linn, 2013; Walberg, 2011). There have been very few observational studies, however, that have examined the use of technology in urban middle school classrooms which serve predominantly minority students from economically-disadvantaged families. The purpose of the present study is to systematically observe the extent to which instructional technology is available and used in middle school classrooms in an urban school district. Although there is substantial evidence that indicates that technology-enhanced instruction is an effective teaching practice for students in urban schools, especially for ELLs and students from high-poverty urban schools (Padrón & Waxman, 1996; Park, 2008; Waxman & Padrón, 2002; Waxman, Padrón, & Arnold, 2001; Waxman, Padrón, & García, 2007), it is not an instructional strategy that has been found to be widely used in urban middle schools.

Methods

Participants

The participants in this study were 64 classrooms from all nine middle schools located in a large urban school district in the south central region of the United States. The school district served predominantly minority students (> 70%) from economically-disadvantaged families (>50%). The classrooms and schools were selected to be included in the study because they had been awarded a Target Technology in Texas (T3) Collaborative grant as part of the American Recovery and Reinvestment Act (ARRA) of 2009. The purpose of the T3 grant was to stimulate the use of educational technology by providing funding so that schools could purchase additional hardware and software, and provide professional development for teachers (Texas Education Agency [TEA], 2011). . The teachers in this study were provided with face-to-face and online professional development throughout the school year as well as individualized coaching sessions from the project director. The professional development emphasized integrating technology into the classroom and improving pedagogy and students' critical thinking skills. The content area distribution among the 64 observed classrooms was nearly equal for mathematics, science, language arts, and social studies.

Instrument

The T3 Overall Classroom Observation Measure is a high-inference instrument used to examine: (a) types and use of technology present in the classroom, (b) teachers' technology usage, (c) students' technology usage, (d) teachers' general instructional behaviors, and (e) students' general classroom behaviors. The T3 Overall Classroom Observation Measure is considered a walkthrough or walkabout instrument that is designed to obtain multiple snapshots of classroom practices in order to provide a rich data picture (Downey, Steffy, English, Frase, & Poston, 2004; Kachur, Stout, & Edwards, 2010; Smith, Cude, Braziel, Waxman, & Smith, 2008). The purpose of this data was not to evaluate individual teachers, but to record the teacher and student behaviors that occurred during the 20-minute data collection period.

The T3 Overall Classroom Observation Measure was adapted from the Classroom Observation Measure (COM) (Ross & Smith, 1996), which measures the extent to which certain effective instructional strategies are demonstrated during a class period. The COM has been used in a number of studies, has been found to be reliable and valid (Ross, Smith, Lohr, & McNelis, 1994; Ross, Troutman, Horgan, Maxwell, Laitinen, & Lowther, 1997), and has been adapted and used recently (Waxman, Padrón, Franco-Fuenmayor, & Huang; 2009). The T3 Overall Classroom Observation Measure was used at the end of the classroom walk-through to rate, on a 3-point scale (1=not at all; 2=some; 3=great), the extent to which technology use and general instructional strategies were demonstrated during the observation period. The amount of technology available in the classroom was also recorded. Finally, subsequent to each walk-through, researchers rated the classroom on its overall implementation of technology, using a 5-point scale (0= no use of technology; 1=low-level use of technology; 2=somewhat meaningful use of technology; 3=meaningful use of technology; 4=very meaningful use of technology).

Procedures

Near the end of the school year, trained observers observed the 64 classrooms for approximately 20 minutes each. The teachers were aware of the week that the observations were scheduled, but they were not aware of the specific day or time that their class would be observed. Classrooms that were involved in nontraditional instructional contexts (e.g., testing) were avoided and attempts were made to revisit them at other days or times. The inter-rater reliability in the present study was .84, which indicates a high degree of consistency among observers. Means and standard deviations were calculated for all variables and multivariate analysis of variance were conducted to examine if there were differences among science, social studies, mathematics, and language arts teachers on (a) the extent to which technology was available, (b) the extent that technology was observed being used, and (c) their instructional behaviors.

Results

Table 1 (below) displays the means and standard deviations for the availability of technology in the 64 classrooms, and teachers' and students' use of technology. The three types of technology that were most frequently observed were laptop computers (M=6.91, SD=7.29), DVDs/CDs and headphones (M=2.55, SD=7.43), and desktop computers (M=1.63, SD=3.34). It should be noted that the standard deviations for these three items were large which indicates that there was a large variation in the number of these items that were observed in the classrooms. Despite the technology being present in the classroom the observations revealed that laptops were being used only to some extent (M=1.67, SD=0.90), while desktop computers and DVDs/CDs and headphones were not being used at all (MDesktop=1.19, SDDesktop=0.57; MDVDs=1.08, SDDVDs=0.37). These results indicate that the technology being present does not guarantee that it will be used in the classroom. Another interesting finding was that almost every classroom that was observed had an interactive whiteboard (M=0.98, SD=0.33) that was being used to some extent (M=2.11, SD=0.97). It appears that teachers were comfortable integrating this technology into the classroom. One possible reason for this is that teachers might have received training on the integration of interactive whiteboards during their professional development, while training for other forms of technology might not have taken place.

Table 1

Summary of Classroom Observations of Technology Availability and Use

	Tech Availability		Tech Use	
Type of Technology	*M*	*SD*	*M*	*SD*
MP3 player/iPod	0.30	1.41	1.00	0.00
Interactive whiteboard/ SMART Board	0.98	0.33	2.11	0.97
Flip camera/ video camera	0.80	1.71	1.03	0.18
Digital camera	0.47	1.36	1.08	0.37
DVDs/CDs & headphones	2.55	7.43	1.08	0.37
Skype/ video communication	0.44	2.29	1.02	0.29
Laptop computer	6.91	7.29	1.67	0.90
Desktop computer	1.63	3.34	1.19	0.57
Television	0.42	0.53	1.03	0.25

Notes. The technology availability item is the actual number of specific types of technology observed in the classroom. The technology use item used the following key*:* 1=not observed at all; 2=some extent (once or twice); 3=great extent (3 or more times).

Table 2 (below) displays the means and standard deviations for the use of technology by teachers and students. Teachers were integrating technology into the lesson and using technology to display materials or assignments to some extent (MLesson=2.27, SDLesson=0.86; MDisplay=1.97, SDDisplay=0.94). Teachers were not using technology for non-instructional purposes (M=1.11, SD=0.45). The other items for teachers' use of technology had means between one and two, which indicates that teachers were not observed using the technology or were using it only to some extent. Standard deviation between 0.8 and 0.9 for these items suggest that there was some variation in teachers' use of technology. Students were observed using technology to some extent for (a) enhancing problem solving and creativity (M=1.98, SD=0.92), (b) independent inquiry/research (M=1.94, SD=0.91), and (c) producing new knowledge (M=1.97, SD=0.91). The means for the rest of the students' use of technology items were between one and two with standard deviations around 0.8, which implies that students were either not using technology or were using it only to some extent but there was some variation is student technology use.

Table 2.

Summary of Classroom Observations of Teacher and Student Technology Use

Teacher Use of Technology	M	SD
Teacher integrated technology into lesson	2.27	0.86
Teacher assisted students with technology	1.79	0.88
Teacher used technology as a communication tool (e.g., Skype, email/chat)	1.64	0.88
Teacher used technology to create lessons	1.63	0.88
Teacher used technology to access the Internet	1.45	0.80
Teacher used technology to display material/assignment	1.97	0.94
Teacher used technology to assess/correct assignment	1.56	0.79
Teacher used technology for a non-instructional purpose (e.g., checking email)	1.11	0.45
Student Use of Technology	**M**	**SD**
Students used technology to enhance problem solving/creativity	1.98	0.92
Students used technology to learn basic skills (e.g., tutorials, drill & practice)	1.73	0.84
Students used technology to access the Internet	1.70	0.85
Students used technology as a communication tool	1.41	0.75

(e.g., Skype, email/chat)		
Students used technology for word processing	1.52	0.76
Students used technology for assessment purposes (e.g., individualized tracking)	1.58	0.81
Students used technology for independent inquiry/research	1.94	0.91
Students used technology to produce new knowledge	1.97	0.91

Table 2 continued

Teacher Instructional Behavior	*M*	*SD*
Teacher actively facilitated students' engagement in activities and lessons to encourage participation	2.09	0.87
Teacher linked concepts and activities to one another and to previous learning	2.08	0.84
Teacher applied new concepts to similar situations (elaborated)	1.81	0.87
Teacher connected ideas and concepts	1.89	0.79
Teacher initiated experiences, discussions and activities	1.91	0.90
Teacher acted as coach/facilitator	2.15	0.90
Teacher allowed students to develop concepts or procedures	2.03	0.88
Teacher provided students opportunities for problem solving	1.92	0.88
Teacher asked many open-ended questions	1.55	0.78
Teacher provided adequate feedback to students (answers, information, etc.)	2.02	0.90
Teacher provided direct instruction for the entire class	1.75	0.91
Teacher assisted students to organize thinking (identify and describe patterns)	1.76	0.87
Teacher integrated feedback and assessment into instructional cycle	2.21	4.03
Teacher initiated project-based learning activities	1.78	0.92
Teacher let students develop concepts or procedures	2.10	1.44
Teacher related concepts to students' actual lives	1.37	0.68
Teacher provided opportunities for students to assume responsibility and initiate classroom activities	1.95	0.92
Teacher used a variety of modalities including auditory, visual, and movement	1.74	0.81

Table 2 continued

Teacher Instructional Behavior	*M*	*SD*
Teacher provided opportunities for students to be creative and/or generate their own ideas and/or products	1.81	0.91
Teacher offered encouragement of students' efforts that increased students' involvement and persistence	1.98	0.83
Teacher appeared to have warm, supportive relationships with students	2.27	0.78
Teacher displayed negative affect toward students	1.17	0.42
Teacher monitored/checked student work	2.13	0.85
Students' Instructional Behaviors	***M***	***SD***
Students initiated and assumed responsibility for learning activities	2.28	0.88
Students connected ideas and concepts	1.94	0.85
Students utilized different ways to answer (alternative solutions)	1.65	0.81
Students were engaged in classroom activities	2.34	0.78
Students' activities were learner-centered	2.10	0.91
Students solved problems using real objects (e.g., manipulatives) in the classroom environment	1.48	0.67

Students displayed positive affect toward teacher	2.23	0.83
Students displayed negative affect toward teacher	1.22	0.55
Students displayed positive engagement with peers	2.16	0.86
Students worked with other students in small groups	1.89	0.92
Students displayed disruptive behavior	1.27	0.57
Students did independent seatwork	2.11	0.90

Table 2 continued

Overall Classroom Technology Rating	*M*	*SD*
Overall technology rating	1.92	1.46

Notes. All technology use items used the following key*:* 1=not observed at all; 2=some extent (once or twice); 3=great extent (3 or more times). The overall classroom technology rating used the following key: 0=No use; 1=Low-level use of computers; 2= somewhat meaningful use; 3=meaningful use; 4=very meaningful use of computers.

The means for teacher and student instructional behaviors are also shown in Table 2. Overall, most teachers' instructional behaviors were observed to some extent. One item (the teacher asked many open-ended questions) was observed either not at all or to some extent (M=1.55, SD=0.78). Two items, on average, were not observed at all. These two items were the teacher related concepts to students' actual lives (M=1.37, SD=0.68) and the teacher displayed a negative affect toward students (M=1.17, SD=0.42). Fairly high standard deviations for all items indicate that there was variation in the teachers' instructional behaviors that were observed. Most student instructional behaviors were also observed to some extent. One item (students solved problems using real objects) had a mean between one and two (M=1.48, SD=0.67) again indicating that this item was either not observed or observed to some extent. There were also two items (students displayed negative affect toward teacher and students displayed disruptive behavior) that were not observed (MNegative Affect=1.22, SDNegative Affect=0.55; MBehavior=1.27, SDBehavior=0.57). The standard deviations for all items were again high, suggesting variance in the observed student instructional behaviors.

The overall classroom technology rating for the 64 classrooms was 1.92, which indicated that the technology observed in these classrooms was "somewhat meaningful." The standard deviation for this item was quite high (SD = 1.46), indicating that some classrooms were not using technology while other classrooms were using technology in very meaningful ways.

A MANOVA was used to determine if there were any significant differences between content areas for teacher and student technology use and instructional behaviors. The MANOVA results indicated that there were no statistically significant differences by content area for technology use or instructional behaviors. In other words, there were no differences among science, social studies, mathematics, and language arts teachers on (a) the extent to which technology was available, (b) the extent that technology was observed being used, and (c) their instructional behaviors.

Discussion

Developing students who can participate in a global economy that is increasingly more focused on technology is one of the greatest challenges facing educators today. The findings of the present study indicate that computers are not fully integrated into the delivery of instruction in the nine middle schools in this urban school district. In fact, the acquisition of technology in the school district examined in this study has clearly exceeded the amount of technology infusion. These findings are similar to other studies that have also found that the quantity of computers in the classroom does not appear to be a key factor that affects teaching and learning, but rather the way computers are used in instruction that appears to makes a difference (Lei & Zhao, 2007; Lowther & Ross, 2003).

The findings from the present study indicate that technology availability in this urban school district is higher than previous studies (probably due to the T3 grant), but technology use in the present study is lower than the findings reported in other studies. This may be due to the fact that the present study observed regular classroom instruction rather than relying on administrator, teacher, or student self-reports of technology use. In addition, the present study did not observe students attending computer laboratory settings, where students often learn about computers in general. Consequently, the results from this study may provide a much more realistic assessment of instructional technology use in urban middle school classrooms. Informal conversations with teachers revealed that they felt so pressured to have their students do well on state-mandated tests that it hindered their technology use in the classroom. These perceptions, however, need to be systematically examined in future studies with more in-depth surveys or interviews.

The results of the present study suggest that the technology has not been thoroughly implemented in these urban middle school classrooms that serve a large number of minority students. Although the teachers who participated in the present study were volunteers and were provided with several professional development opportunities on how to integrate technology in their content areas, this training did not appear to be sufficient for them to fully implement technology in their classrooms.

For the most part, instruction in these urban middle school classrooms was predominantly student-centered with teachers actively engaging students in classroom activities by acting as a coach/facilitator. Although technology has been found to be a better fit with more constructivist approaches to teaching rather than the traditional lecture, recitation, drill and practice approaches that are most common in schools today (Collins & Halverson, 2009; Wenglinsky, 2005), this was not the case for the present study.

This study is limited in the fact that it only observed middle school classroom in one urban school district. Additionally, observations only occurred once for a 20-minute period. Future studies should examine classrooms in other urban districts and should include several observations for longer time periods. Teacher and student interviews would also provide further insight into the factors that play a role in the successful integration of technology in the classroom.

The findings from this study also raise several other important questions that need to be addressed in future studies. Most of these questions center on determining: (a) the skills and abilities that teachers need to effectively implement technology, (b) the factors that constrain teachers from using technology, and (c) the types of support teachers need to implement the use of technology throughout their instruction. Future research may also want to examine the use of walkthrough or walkabout data for providing feedback to teachers or administrators about the quality of technology use and classroom instruction. By finding the answers to these questions future research may show how technology can help urban middle school students achieve academic success both in the present and in the future.

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