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Pattern of classroom activities during students' use of computers: Relations between instructional strategies and computer applications

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ABSTRACT

The purpose of this study was to identify instructional strategies used by teachers to support technology integration. In addition, relations between types of computer applications and teachers' classroom practices were examined. Data were direct observation results from 143 integration lessons implemented in schools receiving federal technology grants. Results reflect use of student-centered practices such as teacher as a facilitator, project-based learning, and independent inquiry. Furthermore, this study revealed that classroom practices tend to be more student-centered when students use the computer as a learning tool such as the Internet, word processing, and presentation software. Conversely, drill and practice software showed a dissimilar pattern.

Technology implementation in schools has been a major focus of educational reform and policies for several decades (Culp, Honey, & Mandinach, 2003; Web-Based Education Commission, 2000). Within the last decade, over $40 billion was spent to place computers in schools and provide Internet connections to each school (CEO Forum, 2001; Dickard, 2003). Consequently, the student-to-Internet-connected computer ratio has improved; today, almost every school has Internet access and about one computer per every four students (Bausell, 2008; National Center for Education Statistics [NCES], 2004).

Unfortunately, increased availability of technology in the school has not lead to overall improvement in classroom teaching practices (Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001; Rutherford, 2004; Windschitl & Sahl, 2002). The computers are rarely used as learning tools, which would not only extend student abilities to solve problems, create products, communicate and share their perspectives with others, but also build 21st Century knowledge and skills (Jonassen, Howland, Marra, & Crismond, 2008; Morrison & Lowther, 2010; Partnership for 21st Century Skills, 2004; Tondeur, van Braak, & Valcke, 2007). Teachers mainly use computers as delivery tools to present instructional content or to engage students in the use of computer-assisted learning applications such as drill and practice, tutorials, and simulations (Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008; Moursund & Bielefeldt, 1999; O'Dwyer, Russell, & Bebel, 2004; Smeets, 2005).

The use of computers as a delivery tool has been the trend for more than a decade, as a 1994 report by Becker (1994) revealed that students at the elementary level used computers extensively to do drills or play educational games rather than as learning tools. An early study by Rakes, Flowers, Casey, and Santana (1999) found that approximately one-third (66.4%) of the 435 teachers surveyed reported that their students used drill and practice type software in the classroom as a regular part of their curriculum, however, 74.7% reported that their students did not use basic desktop publishing software. More recent studies have found that little has changed since Becker's 1994 findings. A study by Ross, Smith, Alberg, and Lowther (2004), which presented findings from almost 10,000 classroom observations, also revealed that technology was used infrequently as a learning tool, but rather used to deliver instruction such as drill and practice. Relatively few teachers who used computers in their classroom had students use analytic and project-oriented software, but instead, they personally used content delivery tools to support their teaching (Smeets & Mooij, 2001). This type of use is not sufficient to provide students with the essential skills such as critical thinking and problem solving for economic survival in a 21st Century work environment (Casner-Lotto & Barrington, 2006; Dickard, 2002; CEO Forum, 2001).

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In contrast to the aforementioned studies, researchers show evidence that use of computers as learning tools can improve the nature of teaching, student learning, and problem solving (Butzin, 2001; Grant, Ross, Wang, & Potter, 2005; Kozma, 2003; Lowther, Ross, & Morrison, 2003; Means & Golan, 1998). Unfortunately, as mentioned the use of technology as a learning tool to support student learning in K-12 schools has not been a common teaching practice (Ertmer, Addison, Lane, Ross, & Woods, 1999; Vannatta & Fordham, 2004). Based on data collected from approximately 2156 K-12 teachers, Barron, Kemker, Harmes, and Kalaydjian (2003) found low use of technology to support student productivity, research, or problem solving. Teachers indicated that when the computer was used as a learning tool, the primary purpose was to search for information or to write papers (Wozney, Venkatesh, & Abrami, 2006). Other studies have found that one of the most commonly used software in K-12 settings is word processing due to teacher familiarity with the software, which in turn reduces the need of technical support (Becker & Ravitz, 2001; Ross & Lowther, 2003). Not surprisingly, the Internet is reported as one of the most commonly used digital tools in K-12 classrooms (Muir-Herzig, 2004; Wozney et al., 2006).

1. Relations between instructional strategies and type of computer software

Studies related to K-12 technology integration typically provide a profile of computer availability, Internet access, and type of software use. However, the examination of relations between teacher pedagogical practices and type of computer application gets little attention. In multiple studies, teachers' pedagogical orientation and practices toward technology use in the classroom were differentiated into two broad categories: teacher-centered and student or learner-centered (Becker, 2000; Ertmer et al., 1999; Niederhauser & Stoddart, 2001). For example, a study by Niederhauser and Stoddart (2001) indicated a significant relationship between teachers' pedagogical perspectives and the type of software used by the students in the classroom This study showed that teachers with learner-centered perspectives preferred to have their students use "open-ended software," which allows active student participation, production, and construction of knowledge with tools such as word processing or presentation software. On the other hand, teachers with traditional teacher-centered orientation leaned toward skilled-based software such as tutorials and/or drill and practice. These findings support those of Becker (2000), which indicated that teachers with constructivist-oriented pedagogies frequently assign students to use digital learning tools such as presentation, spreadsheet, and word processing that require input and analysis of information.

Although previous studies examined the relation between teacher pedagogical orientation and practices and student use of computers, most of these studies relied on self-report data from teachers. As several researchers point out, teachers usually have some notion concerning desirable answers, so these types of data may be unreliable and biased or provide limited and invalid information (Hakkarainen et al., 2001; Kopcha & Sullivan, 2007). Furthermore, Hakkarainen et al. (2001) indicated that there is even a discrepancy between teachers' pedagogical perspectives and their reported classroom practices. Ertmer, Gopalakrishnan, and Ross (2001) suggest that researchers should focus on what teachers are doing in terms of beliefs and practices regarding computer use in the classrooms. Therefore, it is important to observe and record type of computer software and how and to what extent these applications are used in actual classroom settings. This study examined the pattern between types of computer applications and classroom practices based on realistic data gathered by direct classroom observations. Specifically, the following research questions were addressed:

- What type of classroom orientation, instructional strategies, and student computer activities are conducted in technology-integrated classrooms?
- Is there any common pattern between types of computer activities (production software, Internet and research software, and educational software) and classroom practices (classroom orientation, instructional strategies, and student activities)?

2. Method

2.1. Participants

The 39 participating schools were located in Tennessee and had received federal funding from the US Department of Education to implement school-wide technology initiatives. Thirteen of the schools had received Title II Part D (EdTech) funding from the No Child Left Behind Act and 26 received funding from the Technology Literacy Challenge Fund (TLCF). Both grants required whole-school professional development under the guidance of a full time technology coach. The data from this study were collected from 143 classroom observations of full (45–60-min) pre-scheduled technology integration lessons at both EdTech ($N = 39$) and TLCF ($N = 104$) schools.

2.2. Data collection instruments

Two instruments were used to descriptively, not judgmentally record observed classroom practices: the School Observation Measure (SOM©) (Ross, Smith, & Alberg, 1999) and the Survey of Computer Use (SCU©) (Lowther & Ross, 2000). Both instruments had been shown to be reliable and valid (Lewis, Ross, & Alberg, 1999; Lowther & Ross, 1999; Lowther et al., 2003; Ross et al., 2004; Sterbinsky & Burke, 2004). In addition, trained, unbiased site researchers conducted all data collection procedures.

2.2.1. SOM

The SOM was developed to determine the extent to which different common and alternative teaching practices are used throughout an entire school or in a targeted 1-hour lesson (Ross et al., 1999). The observer examines classroom events and activities descriptively, not judgmentally. Notes are taken relative to the use or nonuse of 24 target strategies. The target strategies include both traditional practices (e.g., direct instruction, independent seatwork, and technology for instructional delivery) and alternative, predominately student-centered methods associated with educational reforms (e.g., cooperative learning, project-based learning, inquiry, discussion, using technology as a learning tool). An inter-rater reliability study of SOM with trained observers was conducted by Lewis et al. (1999). The study indicated that pairs of observers selected the identical response on the five-category rubric on 67% of the observation form items. Agreement within one category occurs 93.8 of the time and within two categories 100% of the time. A more recent reliability study (Sterbinsky & Burke, 2004) found similar results in that observer ratings were within one category for 96% of the whole-school observations and for 91% of the targeted observations.

2.2.2. SCU

The SCU is a companion instrument to the SOM and was also used during the targeted observations (Lowther & Ross, 1999). The SCU was designed exclusively to capture student access to, ability with, and use of computers, rather than teacher use of technology.