Lasting Impact of a Professional Development Program on Constructivist Science Teaching

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Abstract

This study was conducted to examine the effectiveness of the GK-12: Lowcountry Partners for Inquiry program that included an emphasis on constructivist teaching methods for science teachers and science graduate students. The goal was to monitor middle school teachers’ use of constructivist practices in their classrooms two years after their last program experience. Classroom observations, Constructivist Learning Environment Surveys (CLES), and interviews were conducted to assess their use of constructivist practices. Data suggest that teachers’ use of constructivist practices increased following completion of the GK-12 program. Scores in each of the five CLES categories were significantly higher two years post program involvement than at the end of the program ($p < 0.05$). Teachers reported that they not only continued but also increased their use of constructivist practices because of the increased achievement and improved critical thinking skills of their students.

Introduction

Social scientists have recognized the value of a constructivist learning approach for a number of years (Moussiaux & Norman, 1997). Bolliger (2004) reported that this approach fosters active learning and the development of critical thinking skills. Investigation of pedagogy and constructivist teaching and the impact of its use on achievement are ongoing. Although there are many aspects to constructivist teaching methods in the classroom, the practice is broadly defined below:

Constructivism is a view of learning that sees learners as active participants who construct their own understandings of the world around them. Using past experiences and knowledge, learners make sense of the new information that they are receiving. (Brown & Adams, 2001, p. 7)

Nix, Fraser, and Ledbetter (2003) note that constructivist teaching models include (1) personal relevance, (2) scientific uncertainty, (3) critical voice, (4) shared control, and (5) student negotiation. Personal relevance emphasizes the individual while the curricula focuses on personal growth, autonomy, and the concept that material to be learned has a unique meaning. In a constructivist classroom, students create meaning through activities that use manipulatives, questions, and relevant experiences. Students who understand scientific uncertainty are encouraged to
question what they are learning and ask questions that will help them gain a better understanding (Van Sickle, Tempel, Gaskill, & Tempel, 2005). In a constructivist classroom where scientific uncertainty is emphasized, students see knowledge that arises from theory-dependent studies. That knowledge is acquired in a social context that is evolving with the human experience (Johnson & McClure, 2000).

Freire (1985), Simon (1987), Giroux and McLaren (1989), and Lensmire (1995) describe critical voice by emphasizing students’ involvement in the dialogue to the extent that their “voices would sound and be heard” (Lensmire, 1995, p. 1). Critical voice is developed by the teacher to foster a social climate in which the students feel it is appropriate and legitimate to question the teacher’s approach and methods (Van Sickle et al., 2005). The teacher’s role in a constructivist classroom also changes from bestowing information to orchestrating discussion and mediating activities through which students gain an understanding of concepts through action. Classrooms that provide shared control engage in constructivist teaching practices that tend to be more student-centered with an emphasis on student input and action. In such an environment, shared control is fostered as the teacher invites student input to jointly determine the learning environment (Johnson & McClure, 2000). Student negotiation occurs as teachers provide students with the opportunity to describe and justify their new ideas about content (Taylor, Fraser, & Fisher, 1995; Van Sickle et al., 2005). In the constructivist classroom, students are viewed as collaborators who work together in the learning process. Moreover, student negotiation and input is critical in the discussion of concepts so that students are able to create an understanding based on their current knowledge.

Constructivism is a theory of learning rather than one of teaching, and some skepticism has been raised over its implementation (Richardson, 2003). Many people believe that the essential elements of effective constructivist teaching are unknown. Arguments have been made that in order for teachers to be effective constructivist teachers, they must have strong depth of content knowledge. Subject knowledge may be adequate in secondary schools, but it is not as common at the elementary level where educators teach many different subjects at a time. There is also a disregard for a constructivist approach among some teachers, especially veterans, who believe that the approach creates a chaotic and disruptive classroom environment (Richardson, 2003). Many teachers lack a strong belief in the effectiveness of constructivist teaching methods in the classroom and are thus unlikely to use these practices. In a study completed by the Washington School Research Center, a total of 669 classrooms were observed in 34 schools. Strong constructivist teaching was observed in only 17% of the classroom lessons (Abbott & Fouts, 2003).

On the other hand, many teachers have a strong belief in constructivist practices and do their best to implement them, but they often lack administrative support (Dempsey, 2002; Haney & McArther, 2002). Many principals do not want to take the time or resources to reform programs to include constructivism. Teachers also complain that principals do not understand the need for financial support for hands-on manipulatives in lieu of textbooks. Principals may also give teachers poor evaluations for using their textbooks as a reference rather than as a primary source (Dempsey, 2002) and may perceive the constructivist classroom environment as chaotic and lacking teacher control. Finally, some teachers argue that few professional development programs are given about constructivist teaching practices (Dempsey, 2002). Loucks-Horsley, Love, Stiles, Mundry, and Hewson (2003) found that “Historically, professional development has focused on only adding new skills and knowledge without helping teachers to rethink and discard or transform thinking and beliefs” (p. 46). This type of professional development leaves teachers feeling