Argument-Based Inquiry and Students with Disabilities: Improving Critical Thinking Skills and Science Understanding

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Abstract: The author will provide an overview of the Science Writing Heuristic (SWH); an argument-based inquiry approach to science instruction. This approach shown promise in improving science scores and critical thinking assessment scores for students with disabilities. The SWH approach incorporates the use of argument and hands-on experiences to increase science achievement by improving critical thinking skills. Instructional components of the SWH approach and data supporting its use for students with disabilities will be presented.

Students with disabilities have long lagged behind their general education peers in all academic areas. As debate persists regarding whether or not general science education is in a state of crisis, there is little disagreement in that when it comes to students with disabilities and science education there is a significant deficit in achievement. Since the late 1980’s, advocates for students with disabilities have recommended greater emphasis be placed on teaching science to students with disabilities (Mastropieri & Scruggs, 1992; Patton & Andre, 1989). However, even with increased accountability standards for students with disabilities (NCLB, 2001) and the push for better general education access, students with disabilities have not made significant gains in the areas of science education.

In general, students with mild intellectual disabilities are rarely considered in the teaching and learning of science. Mastropieri, Scruggs, and Boone (1998) conducted a review of the research to that point of students with disabilities and science education. They reported a number of issues as possible causes of poor science achievement for students with disabilities. Some of these issues included: teachers’ manuals not addressing students with disabilities perspectives, literacy demands, and teaching approaches (Mastropieri, Scruggs, & Boone, 1998). As inclusive and collaborative teaching of students with special needs increases in general education classrooms, a number of additional issues have emerged as concerns. Many general education teachers feel ill prepared to teach students with disabilities (Soodak, Podell, & Lehman, 1998). Patton, Polloway, and Cronin (1990) reported a number of disturbing revelations including: over two-fifths of special education teachers receive no training in science education, over one-third of students with disabilities in self-contained classes receive no science instruction, nearly two-thirds of special education teachers use the general science education textbook to teach.

The Science Writing Heuristic (SWH)

The Science Writing Heuristic (SWH) is a teaching approach designed to involve students in inquiry, argumentation, and experimentation as a means of learning. Based on the theories that include writing-to-learn strategies as a means of teaching and learning science (Yore, Bisanz, & Hand, 2003), the SWH approach was developed as a means of providing students a conceptual framework for science knowledge through constructive debate and experimentation while simultaneously allowing for multiple means of expression to display robust understanding of science themes and concepts. Using teacher directed, individual and small group instruction, students learn how to generate testable questions, conduct investigations, generate claims based on their investigations, and back their claim with evidence. While based in inquiry-teaching theory, the SWH approach incorporates teaching and learning structure that allows access to better educational opportunities more students including those with mild intellectual disabilities. The use of structured components in tandem with inquiry-based instruction has been recommended by researchers as a more viable means of including all students and maximizing science learning opposed to one dominant teaching methodology (Mayer, 2004; Scruggs & Mastropieri, 2007). The components
of the SWH approach allow students with disabilities to actively engage in science instruction and scientific practices through the improvement of critical thinking skills.

**Methodological Approach**

The aims of the authors were to test the efficacy of the SWH approach with an experimental design using a random assignment of buildings to treatment and control groups. The project seeks to examine the efficacy of the SWH approach for students with disabilities by tracking the following:

1. Grade 3 – 6 students with disabilities performance comparing treatment and control scores on the Iowa Test of Basic Skills (ITBS) science subscale.
2. Grade 5 – 6 students with disabilities performance comparing treatment and control scores on the Cornell Critical Thinking Test (CCT) and subscales.

This random control trial study of the SWH approach included 48 elementary schools (24 treatment and 24 control) in the state of Iowa. The study was designed to examine impact of the SWH approach on students in grades third to sixth with disabilities scores in science achievement (ITBS-Science subscale, grades 3 - 6) and critical thinking skills (CCT, grades 5 – 6).

**Findings, Conclusions, and Implications**

Students’ ITBS scores, CCT test results (grade 5 – 6 only) were used to measure student outcomes and the effectiveness of the SWH approach. To date, grades 3 – 6 students’ ITBS data from 2009 and 2010 have been collected and a database has been developed for analysis. The CCT pre-test was administered at the beginning of the school year and the post-test at the end of the school year (2010-2011) is currently in progress.

Preliminary data suggest that students with disabilities in the treatment group scored higher than students in control group on ITBS science scores and CCT pre and post-test difference scores. A comprehensive analysis and discussion of the ITBS, Critical Thinking Skills on results for Year 1 will be available after the completion of the data collection.

The data generated and findings presented will be used to inform the recommendations and conclusions of the study.

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