National Center for Research on Rural Education (R²Ed)

Guided Science Inquiry Instruction with Students with Special Education Needs [1]

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Objectives

National and state educational mandates require students achieve proficiency in not only science content, but also *science inquiry,* or those process skills associated with science (National Research Council, 2011; Next Generation Science Standards, 2013). Science inquiry instruction has been shown to improve student achievement and process skills (e.g., Llewellyn, 2002; Schroeder, Scott, Olson, Huang, & Lee, 2007; Minner, Levy, & Century, 2010).

Guided scientific inquiry is a student-centered, teacher-facilitated approach to science instruction where students are guided toward, but not directly presented, scientific concepts. Students are led by the teacher to develop the concept (Trowbridge, Bybee, & Powell, 2004). Guided science inquiry has been found effective in promoting student achievement (e.g., Wilson, Taylor, Kowalski, & Carlson, 2010). However, research has not yet specifically examined the value of guided scientific inquiry among students drawn from the special education population.

Methods

Research Questions

This study sought to answer two research questions. First, how did teachers involved in a study examining implementation of guided science inquiry qualitatively describe their experience implementing guided science inquiry among their students from special education populations? Second, did teachers find guided science inquiry effective to use with students from special education populations?

Participants

Participants in this study consisted of 61 rural Midwestern teachers participating in a randomized controlled trial study who received instructional coaching of guided scientific inquiry instruction as part of the professional development experimental condition. Following completion of coaching, the teachers answered selected questions assessing their experience with guided science inquiry and its effectiveness with students with special educational needs.

Design

This study combined qualitative and quantitative analysis of data. The qualitative component featured analysis of an open-response question asking teachers to describe their experience using guided science inquiry with students from the special education population. Responses were compiled and independently coded into seven categories. Quantitative analysis consisted of comparing frequency counts of teachers' ratings of whether they used guided science inquiry with students from the special education population and how effective they felt it was on a Likert-type scale. Teacher ratings were assessed across two cohorts. The first cohort's effectiveness rating consisted of a five-point scale such that a rating of 1 indicated strong disagreement, 3 was neutral, and a rating of 5 indicated strong agreement. The second cohort received a similar scale, but with six points such that 1=strongly disagree and 6=strongly agree.

The first cohort's ratings were then weighted using the formula

$$Y = 1.25x - .25$$

This formula converted the boundaries of their ratings to allow for comparisons across cohorts, such that 1=strongly disagree, 3.5=neutral, and 6=strongly agree. Both cohort ratings were then combined to provide an overall rating of the effectiveness of guided science inquiry with students from a special education population.

Results

Among the 61 participating teachers, 48 (78.7%) reported using guided science inquiry with students from special education populations. Among those teachers who used guided science inquiry with students from special education populations, 42 (87.5%) reported it was effective in meeting the students' learning needs (Table 1).

Teachers' qualitative responses were analyzed and fell into seven categories (Table 1).
- Teachers discussed the "hands-on" approach to guided science inquiry and said it led to better understanding of the science concepts being taught; that is, the approach better aligns with how students learn.
- Guided science inquiry appeared to allow students with special education needs to be included in a way that traditional lecture-based instruction did not.
- There was evidence that the level of student participation in guided science inquiry lessons was higher than traditional lecture-based instruction.
- One reason for the increased inclusion and engagement appeared to be the fact that guided science inquiry allowed students to each work at their own level *during* instruction.
- Even though not all teachers could quite identify what about guided science inquiry worked for this population, there were several who made comments suggesting that in general, guided science inquiry was better than traditional instruction for students with special education needs.
- Another theme that emerged centered on guided science inquiry being positive for students with special education needs, but only when it was used with some adaptation.
- Finally, the only negative perspectives expressed were opinions that the inquiry process lacked sufficient structure for some of their students with special education needs.

Discussion

Looking through the comments, it became clear that most teachers believed guided science inquiry was a good, if not better, fit for students with special educational needs than traditional instruction. The primary complaint was the general lack of structure associated with guided science inquiry. However, several teachers noted that with some adaptation, guided science inquiry was just as effective with their students with special education needs.

The results suggest that guided science inquiry instruction can be effectively implemented with students from the special education population. The majority of teacher responses suggested that

a guided science inquiry approach provides these students with greater understanding, inclusion, and engagement with their science lessons than do traditional instructional methods. Guided science inquiry's flexibility allows for differentiated instruction. Limited concerns with the approach reported for these students included a need to adapt instruction in order to meet their needs and difficulties among students grasping its occasionally abstract structure.

Future Directions

Future studies could use student outcomes to examine the effectiveness of guided science inquiry instruction, possibly comparing group differences between general and special education populations. As well, this study did not specifically address subpopulations within the much broader "special education" category. Future studies might wish to assess the utility of guided science inquiry among target groups such as students with attentional deficits and related challenges.

References

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Table 1.
Teacher ratings of inquiry's effectiveness for students with special educational needs (n = 46).

	Disagree	*Somewhat Disagree*	*Neutral*	*Somewhat Agree*	*Agree*	*Strongly Agree*
Number of Ratings (% of total)	*2 (4.3%)*	*1 (2.2%)*	*1 (2.4%)*	*13 (28.3%)*	*17 (37.0%)*	*12 (26.1%)*

Table 2.
Categories of Teachers' Descriptions of Experience Using Inquiry with SPED Students

CATEGORY	REPRESENTATIVE QUOTES
HANDS-ON APPROACH LED TO BETTER UNDERSTANDING	• "Instead of relying so heavily on text, these students can be prompted for review with what they did instead of what they read." • "The entire process worked well. The students were able to discover topics that I wanted them to learn without me having to come right out and tell them. The process was hands on which enhanced the way that my students with special needs learn."
BETTER INCLUSION/INCREASED ACCESS FOR SPED STUDENTS	• "My special needs students were able to work side-by-side with my upper level students because they were able to work at their own pace and explore with everyone else."
INCREASED INTEREST AND ENGAGEMENT/PARTICIPATION	• "They were more engaged and seemed to think deeper about the content than with traditional instruction." • "They were genuinely engaged in the learning and were not afraid to join in the discussions."
STUDENTS CAN WORK AT THEIR OWN INDIVIDUAL "LEVEL"	• "It allows each student to work at a different level. Then everyone is able to contribute to the end result." • "This approach allowed the teacher to meet the student at their level of understanding and bring them forward through the learning process"
GENERALLY POSITIVE/BETTER THAN TRADITIONAL INSTRUCTION	• "Special needs students seemed to do better with inquiry especially ADD." • "Their conclusions were at a more basic level but worked well with the process in general." • "I find that special needs students are more receptive to and successful with the interactive inquiry approach than the traditional lecture, pen and paper methods."
REQUIRED SOME ADAPTATION FOR SPED STUDENTS	• "With SPED students, I had to adjust my questioning and start out with more basic - knowledge/recall." • "They needed more 'leading' in the questions to get to the desired outcome."
INQUIRY PROCESS LACKED SUFFICIENT STRUCTURE	• "Caused frustration with a few students who dislike change. Sometimes was too abstract for understanding." • "Inquiry relies on higher order thinking and applying previous knowledge to new situations. This is a major struggle for some special needs students and they are quick to give up on themselves."