Using Action Research to Examine Teacher Strategy Effectiveness

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ABSTRACT

Successful teachers strive to ensure that their students learn to their maximum abilities. Is action research a valuable way for graduate students to review their effectiveness as teachers? Do students learn more through varied teaching strategies and techniques? The authors examined graduate students' perceptions of action research projects analyzing student achievement. Three middle school teachers conducted the action research projects with their assigned students.

This article has two purposes: 1) to share experiences encountered while creating an action research project and implementing the plan; and 2) to share summaries of graduate students' action research.

INTRODUCTION

Do diverse teaching strategies affect middle school students' academic achievement? Effective teachers find what works best for their students while taking into account several factors, including student ability levels, state-mandated curricula topics, time available in class, and their own personal teaching styles. The authors reviewed three action research projects conducted by education graduate students assigned to teach middle school students. These projects analyzed student achievement. The action research projects were completed as part of an assignment in a graduate-level course in a state university in the southeastern United States. Two of the graduate students focused on science content and one focused on reading content.

The first stage of the research process was to develop an action research plan that reached across all ability levels and which could be adapted to state-mandated student performance indicators. Each graduate student conducted his/her own action research project based upon his/her individual classroom students and needs.

RELATED LITERATURE

Action research is defined as "any systematic inquiry conducted by teacher researchers, principals, school counselors, or other stakeholder in the teaching/learning environment to gather information about how their particular schools operate, how they teach and how well their students learn (Mills, 2007 p. 5). According to Keating et al (1998) the basic idea of action research has been known for some time. The premise is that teachers who are in the classroom recognize problems there and that with some training can review the challenges and make the classroom better.

Teacher/researchers described:

> A reflective elementary, secondary, or postsecondary classroom teacher identifies a persistent teaching problem or question and decides to initiate a classroom inquiry. This teacher reads theoretical and applied educational literature, including other teacher-research reports, and decides to work collaboratively with a colleague. Using primarily practical, efficient, qualitative methods recommended by other teacher researchers, with perhaps a quantitative tool added in, the researcher initiates a study. The teacher learns from and along with students while engaging in the investigation, and she or he finds that the research questions have been altered somewhat throughout the course of the study. The investigator may struggle to balance the dual role of teacher and researcher or feel uneasy with the innovations that are explored. The teacher researcher decides to share the research story publicly and writes it for publication, using a narrative style that includes figurative language and verbal and visual illustrations (Bauman & Duffy, 2001, p. 611).

The National Science Education standards note the importance of teachers conducting research, as provided in Standard C relative to professional development. This standard states, in part, that science teachers must "provide opportunities to learn and use the skills of research to generate new knowledge about science and the teaching and learning of science" (National Research Council, 1996, p. 98). Good teachers regularly review their teaching practices to ascertain what techniques provide success for their students. The National Association for Research in Science Teaching espouses the theme "Every teacher a researcher," thus encouraging teachers to conduct valid research in their classrooms (Martin, 2003, p. 496). Moreover, researchers, including van Zee (1998), advocate sharing research results through conferences or publications. Action research provides an avenue for classroom teachers to collaborate and examine their teaching while reflecting and refining methods to improve student achievement, attitudes, interest, and participation. The reflection process is ongoing and includes deciding upon a topic, collecting data, interpreting and examining data, and taking action (Glanz, 2005).

The constructivist theory purports that students come into the science classroom with ideas and experiences instead of simply waiting for knowledgeable teachers to fill their empty brains. In this context, students are active learners and teachers serve as managers of classrooms (Fosnot, 1996). Similarly, the Institute for Learning Centered Education (2007) maintains that constructivism is not a teaching strategy, but a theory concerning how students learn. Schulte (1996) concludes that constructivism is, in effect, students' knowledge and personal experiences allowing them to construct their own understanding of learning.

Research shows that students with varied ability levels perform better in a guided inquiry setting. Science programs based on inquiry methodology, including graphing skills, laboratory skills, and interpreting data, proved beneficial to middle school science students (Mattheis & Nakayama, 1988). Cuevas, Lee, Hart, & Deaktor (2005) found that an inquiry-based intervention program for diverse third and fourth grade students enhanced their achievement. Another study indicated that learning disabled students scored better on unit tests after receiving instruction using the inquiry technique as opposed to textbook instruction (Scruggs, Mastropieri, Bakken, & Brigham, 1993).

Further, there are a large number of strategies used to teach reading. Direct instruction emphasizes fast-paced, scripted rule-based and highly focused lessons (Houchins, Sartor, Shippen, & Stevenson, 2005). This strategy is used successfully with students with special needs, often utilizing small group instruction. Direct instruction seems to be an option for raising student reading achievement (Iver & Kemper, 2002). Additionally, teachers can assist struggling middle school students by using content topics to teach reading. As content knowledge increases, reading achievement improves (Palumbo & Sanacor, 2009).

Even when provided with varied strategies, some students are not successful readers. Reading instruction is a significant area in a child's education. Students who are not successful readers often face greater and more failures in school and in life (Jolivette, Lingo, & Staton, 2006). Teachers must utilize a variety of methods to reach students. Tompkins (2010) suggests ways to work with students who struggle. She states that effective teachers improve literacy through differentiated instruction, attend professional development opportunities, team up with a literacy coach, and utilize suitable materials for instruction.

METHOD

Conducting Action Research Projects

Graduate Student A: Middle School Science.

Graduate Student A (GSA) Research Question: How can I change my students' attitudes towards science and increase their learning? GSA teaches seventh grade science in a rural area whose 102 students are at or near the poverty level; 83% receive free or reduced lunch. Sixteen students have previously been retained; 40% have spent from 60-100 days in In-School Suspension and/or Alternative School.

GSA noted that his students did not participate in class discussions or appear interested in science class. These same students had been assigned to GSA as fourth graders, so he particularly noticed that even those who had been interested and good students while in fourth grade were not achieving at the same levels as previously displayed.

In order to gain insight on these changed behaviors, GSA created and distributed a short survey to 102 students. He received 72 responses. The questions and top responses include:

1. What is "science?'
   a. I don't know—47%
   b. Science is about how things are made—15%
2. Do you like science? Why or why not?
   a. Yes—you get to learn about new things—12%
   b. No—It is too hard—73%
3. How is science different now than when you were in the fourth grade?
   a. It's harder—33%
   b. It's not fun anymore—60%
4. How can science be more interesting?
   a. Do activities/projects—82%

After reviewing the surveys, GSA determined that students did not like science because it was too hard and it was not fun. Upon further investigation, GSA found that as the students got older, they participated in fewer hands-on activities and received more lectures. Talks with peer teachers revealed that they felt obligated to cover the material for all students. Of particular note was that of the 102 students, 76 had not scored proficient on the state-mandated test, and only three were above proficient for the past three years.

GSA created a lesson that asked students to count the number of insects that could be found in the school yard. Specific instructions were not provided. Students were organized into groups of two or three and received these guidelines.

1. Each group had a 50 minute class period to come up with their method and list of needed materials
2. Once they were outdoors, student groups had 40 minutes to identify and tally insects.
3. The total area searched was 9 meters by 48 meters. Tallies were averaged and multiplied by total square meters.
4. Each group used a square meter boundary to complete the tally.
5. Results were to be graphed in Microsoft Excel.

Students collected and interpreted data and generated graphs, then created a PowerPoint presentation to share information with the entire class. This action research project required five class periods, one each for periods for planning, gathering data, interpreting data, inputting data to the graph, and sharing information with discussion of results.

After attending a professional development conference, GSA decided to repeat the activity six weeks later with one major change. The second method incorporated a technique learned during the professional development. Instead of students randomly throwing meter squares, they chose numbers from boxes, one through nine and one – forty-nine. These numbers corresponded to a grid set up in the same area as the first activity. Students compared results of the two activities and found they were quite similar.

Students were intrigued by the activities and the data gathered. GSA was delighted that the students were enthusiastic to participate in collecting data. A bit of coaching was needed during the first couple of days but eventually most participated and enjoyed doing science. Their eagerness was very apparent during the second activity. GSA found that interested students participated in class more. Further, they were eager to continue in science lessons that included data gathering and using the science process skills.

Graduate Student B: Middle School Reading.

Graduate Student B (GSB) Research Question: Can a change in instruction improve students' reading abilities? Seventeen resource students in grades seven and eight comprise the population, with six boys and three girls in seventh grade, and six boys and two girls in eighth grade. These students have been diagnosed with learning disabilities, although these disabilities should not hinder them from progressing in reading. Students had been taught through whole group instruction and seemed to lack motivation. The students previously used either a reading book or paperback novels in reading.

GSB reviewed three different data sets: classroom grades, STAR Reading (a computerized program), and Benchmark test based on state standards. GSB decided to use the SRA Corrective Reading program to determine the appropriate reading level. The SRA Corrective Reading approach allows teachers to give fast paced, direct instruction to students. This approach allowed for student involvement through individual monitoring, group related reading, and class participation. Lessons are broken into smaller segments and include daily work from which grades are collected. The SRA Corrective Reading approach was utilized for a 12 week period.

Classroom grades raised by ten of the seventeen students; 6 students' classroom grades decreased, and two students' classroom grades stayed the same. Ten of the seventeen students showed gains of .7 to 4 points in their reading range on the STAR Reading test. Three students decreased from .4 to 2 points in their reading range on the STAR Reading test. There were no changes in the reading range of four students. Benchmark tests are based on grade-level state standards. All of the students in this project read below grade level. The Benchmark scores remained unchanged.

GSB found that the majority of the students improved their reading range level that was nearer to their grade equivalent. Measured improvement should be noted as success. If these gains were to continue, students could possibly return to the regular reading instruction program.

Graduate Student C: Middle School Science.

Graduate Student C (GSC) research question: Is the constructivist technique more effective than guided inquiry for middle school physical science? For the purpose of this study, constructivism consists of students building their own knowledge from experiences. The teacher provides the scientific problem under investigation and students create their own steps and procedures to conduct the investigation using available materials. Such a perspective allows for student experiences that encourage construction of new knowledge based on previous knowledge and experiences. For the purpose of this study, guided inquiry is defined as the structured procedure used in completing scientific tasks with the teacher providing the problem to be investigated, the steps to be used to conduct the investigation, and the necessary materials to complete the investigation.

This study involved 83 sixth-grade students in a rural middle school with departmentalized grades three through six. Administrative procedures required assigning students to one of four ability-grouped classes based on standardized reading and mathematics scores. Each group of students participated in daily science instruction for 55 minutes. For this project, each group was

subdivided into clusters, consisting of five to six students each, depending on the class population. The student groups worked together to solve each task, independent of other groups or classes.

Group A included 23 sixth-grade students with standardized test scores in the lowest tier. Twelve of the students received special education services in reading, mathematics, or both, and five students were involved in the Title 1 program for either reading or mathematics or both. Group B included 17 sixth-grade students with standardized test scores in the lowest tier, but who did not qualify for any special services. Group C included 21 sixth-grade students with standardized test scores in the upper tier. Group D consisted of 22 sixth-grade students with standardized test scores in the top tier and included three students identified as gifted.

The classroom teacher designed four tasks to engage students in scientific inquiry while attempting to solve a physical science problem. For each activity, two groups of students were presented with a guided inquiry problem and a set of steps for solving the problem, and two groups were presented with a similar problem, but given the freedom to devise their own solution and construct their own procedures. With each successive task, the groups reversed methods so that no one group continually used the same method to solve problems. With each of the four tasks used for this research, the guided inquiry served as the control.

Students in the lower tier had mixed success with the two problem-solving methods. Those students in group B whose disability was related to attention deficit or hyperactivity seemed to have greater success and were more likely to complete an activity when specific steps were given. Additionally, the students in group A had difficulty developing their own procedures when using the constructivist method. They were free to use any resource, so they resorted to their science textbook and found a similar lesson there. With the text's step-by-step guide, they quickly accomplished their task. Consideration was given to excluding this activity because of the use of the book. Nonetheless, since the students were told that they could use any resource, the activity was accepted.

Pursuant to the research question of whether middle school science students show more achievement gain in physical science knowledge when engaged in constructivist activities than in guided inquiry activities, the data did not support the use of either the constructivist or guided inquiry strategies. Not enough discrepancy was shown in the scores to state which method was more beneficial.

Although a statistical relationship was not found between average scores when comparing science strategies utilized, a relationship was found when comparing average scores between the four groups. Comparisons were made between average points gained and ability groups' placements for tasks 1, 2, and 3. Data showed that average gains were highest for those students placed in the lowest ability group A. Average gains were second highest for those students placed in the second lowest ability group B. Average gains were third highest for those placed in the second highest ability group C. The lowest average gains were for those student placed in the highest ability group D. Interestingly, task 4 average gains mirrored the student placements, with group D posting the highest average gain, group C posting the second highest average gain, and groups B and A tying for the lowest gains.

In addition to these concerns, middle school teachers may experience additional stress because of elementary school practices. With the high stakes associated with today's standardized testing, the lower grades minimize the teaching of science and concentrate on language arts and mathematics as priority subjects (Jones, Jones, Hardin, Chapman, Yarbrough, and Davis, 1999). In fact, primary students may not receive science instruction and, thus, enter upper elementary classes with limited science understanding and experience. Accordingly, middle school teachers feel the pressure of obtaining high student achievement on standardized tests with students who are under-prepared.

CONCLUSIONS AND RECOMMENDATIONS

These action research studies proved beneficial to the researchers, as they were required to step outside of their comfort zones and create situa-

tions to evaluate their teaching methods. Part of becoming a facilitator of learning is giving up complete control of the classroom by allowing students to actively participate in the instructional process. During these projects, students were given the opportunity to think and generate their own plan for solving a task. Many students are not accustomed to that procedure; rather, they are used to simply following directions. Perhaps if students spent time working together and practicing student-centered procedures, the result would be increased academic improvement. Indeed, the students participating in the study found that the process of learning was as important as the outcome.

Additionally, the teachers experienced noteworthy challenges. One constraint experienced was that of insufficient time. Each class period was 55 minutes, and some activities require longer to complete. Problem solving methods vary greatly depending on the skill and experience of the group. When this occurred, students and teachers waiting for them became frustrated.

On a positive note, the teacher observed that students were more interested in science when participating in active learning activities. Most of the students showed excitement about designing their own methods and creating their own problem-solving techniques. Although some students needed a bit more guidance and encouragement, the cooperative learning environment proved a real asset. Completing the tasks in science class provided opportunities for students to think like scientists, and see the importance of communicating with others within the group. The students stated that they had to think and work harder than if they were using only a text.

Due to the study's limitations, follow-up research is recommended including, for example, replicating the project with a larger population of middle school students. Likewise, the research should be conducted over a longer period of time, perhaps beginning at the first of a new school year. Further, students would benefit from more detailed instruction on constructing procedures and lessons. In this manner, students could be gently led into the process.

All three graduate students found their action research project to be effective. Students who are given a voice in their learning become responsible for their education as they prepare for more challenging educational endeavors throughout their lifetime.

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