Final Teacher Research Report

Lanette Fain

ECI 523 Teacher as Researcher

Introduction

After teaching for four years, I found problem solving in mathematics was a continued struggle for many of my students.  I wondered "why do my students struggle with word problems and how can I help them become better problem solvers?” I was frustrated with their inability to be able to accurately explain and answer word or story problems. Story problems are critical for helping children connect different meanings, interpretations, and relationships to mathematics operations (Van de Walle, 2004). Like many other educators, I wanted my students to be capable of knowing how to solve and reason out a problem rather than just memorizing an answer or a process. In mathematics education, the emphasis is on the development of conceptual understanding and reasoning over memorization and rote learning (Goldsmith & Mark, 1999; Hiebert et al., 1996; National Research Council, 2001).

As a third grade teacher this year, I realize how much more important problem solving and critical thinking skills are this year compared to prior years/grades mostly due to standardized testing. Standardized testing begins in third grade and many of the questions asked involve word problems or higher level thinking skills. To demonstrate mastery on these assessments, students are required to fully understand the questions asked and then solve the problems appropriately. Since so many questions are in a story or word question format and require more reasoning and thought processes, students need to be able to process the information and know what steps to take to obtain a reasonable answer. The movement toward competency-based education has helped us to realize that merely teaching students to "know about" various phenomena does not provide an adequate knowledge base for them to function at optimum performance levels (Henton, 1979).

Additionally, I have heard and spoken to many teachers, administrators and parents who are also concerned about their student’s lack of problem solving skills. Further concerns lie with the idea that problem solving is a skill that does not just apply in mathematics and is not just a useful learning tool in the classroom.  It is a skill all students must learn to be successful in their future education, careers, and lives. Therefore it is imperative that we begin to find ways to teach our students how to think and reason out answers so that they can find solutions to any problems they may encounter regardless of the content.

Methodology

The research methods I utilized for this research includes journaling, pre and post assessments and student work samples.

Journaling: I began my research by journaling my thoughts on my teaching and my student’s responses during math each day. This was usually just quick notes about things that stuck in my mind that day or even just how I thought they did with the problem solving questions in the lesson. I started to look into my pedagogy and the resources I was using. From here, I quickly noticed that I was not providing many opportunities for my students to be exposed to and have to solve word problems. My day to day teaching involved the lessons in the textbook which mostly only provided basic arithmetic questions and answers such as “solve 346+289”. Every few days or so there would be a specific lesson involving only word problems and this was where my students, and myself, became frustrated and confused. I noticed many of them immediately raised their hands when I would say “ok, go ahead and do some problems on your own now”. I would walk over and see what they needed and they would tell me they didn’t know what to do. So, I would ask them to read the question and tell me what they needed to do to solve the problem. There were immediately two problems here. First, many of them struggled with their reading skills to accurately read and make sense of the story and question. Second, many of them seemed to just guess whether the strategy was addition or subtraction. If I were to ask them why they picked that particular strategy, they would say they didn’t know.

After gathering these responses and insights, I decided I needed to change some things. First, I started each math lesson with a Problem of the Day that students had to solve independently and explain their answers in writing and then orally if asked. This immediately created more engagement and thinking as they started to think about how and why they got the answer. At first, my more advanced students were the ones to do the answering and explaining but over time, many other students began to discuss their answers and reasoning as well.

Assessments: The next data I began collecting was through a pre-assessment of problem solving questions. The pretest was a 13 question assessment involving one to four digit addition and subtraction problems with and without the regrouping strategy. I gave this assessment at the beginning of my research and also gave the same assessment as a post test at the end of my research to see growth clearly. Each assessment was given to all students on one day at the beginning and one day at the end. The assessment was untimed and students were provided no assistance. Each assessment was then graded and given a raw score and later looked at to find patterns or problems. This was done by examining the students work (if any) on each problem to find if they used the strategies taught in class. For example, did they show how they figured out 3134-1098 by using the regrouping strategy?

Student Work Samples: I also collected some problem of the day work samples to see how they were explaining their reasoning and answers. I looked for ability to accurately explain how and why they figured out their answer which may have involved pictures, diagrams, algorithms, etc. This provided a more thorough insight into what they knew well or what they still struggled with.

Findings

As I looked at the individual assessments I found many interesting patterns and data. First, I looked at the raw scores which were out of a score of 13 possible with 75% needed to demonstrate proficiency. Table 1 shows the data for both the pre and posttests. The data shows that on the pretest, only 6 students were considered proficient and only one student received a perfect score. Additionally, students receiving EC or ESL services did not show proficiency which may correlate with the lack of language, vocabulary and reading skills necessary to accurately answer the word problems. Conversely, post test data shows 11 students demonstrating proficiency with all but 5 students showing growth.

After analyzing the scores I began to look more closely at their work and answers my students gave on the pre-assessment. Many patterns began to emerge and therefore affect my future teaching and planning. For example, many students missed the questions requiring them to use the regrouping strategy for addition or subtraction. So, although this was a second grade concept, I can see that many students have still not mastered this skill. Two students used addition strategies to answer all the questions which again showed a lack of proficiency and mastery. Additionally, some students did not align their digits properly in their work when performing the correct math strategy and therefore found incorrect answers.

With this information, I realized what I needed to reteach and also where I needed to provide more assistance and strategies. I began to look into some of the literature studies I had found prior in my research. I decided to implement a procedure developed by Jitendra, Griffin, Haria, Leh, Adams, and Kaduvetoor (2005). “We redesigned the self-monitoring strategy checklist to

include four steps, and used an acronym, FOPS (Find the problem type, Organize information in the problem using the schema diagram, Plan to solve the problem, and Solve the Problem), to help students remember the steps” (Jitendra et al, 2005). I made a class poster and also handouts for the students to refer to and use during math instruction. I also changed some of my teaching styles and attitudes due to some of the research. For instance, Ornstein (1989) states “students should be taught that errors are often the result of applying the incorrect strategies to problems rather than lack of ability or effort.” I taught my students to think about the mistakes they made and how and why they made those errors. We also discussed daily why we would choose a certain strategy and not another to develop their higher level thinking and reasoning.

After just a couple of months I saw a huge change in their attitudes, abilities and thought processes. First, I noticed that not as many hands went up when they encountered word problems independently. Second, they seemed to get better each day with being able to explain their thinking and why they believed their answers were correct. I rarely ever hear anyone say they don’t know anymore. Finally, after looking at their post test data, many students showed some growth or mastery in a short amount of time. Although many students have still not demonstrated proficiency, the data shows the new strategies are working for many of them.

Table 1

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| --- | --- | --- | --- |
|   | Services | Pre Assessment | Post Assessment |
| Maggie |   | 13 | 13 |
| Bryan |   | 10 | 13 |
| Qwinton |   | 11 | 12 |
| Dakota |   | 10 | 12 |
| Christian  |   | 9 | 12 |
| Mahruhk | ESL | 9 | 11 |
| Karen |   | 9 | 10 |
| Miriah  |   | 9 | 10 |
| Nadiya | AIG | 9 | 10 |
| Ar'Monie |   | 7 | 10 |
| Omar | ESL | 4 | 10 |
| Molly | AIG | 12 | 9 |
| Xavier |   | 11 | 8 |
| Dena | ESL | 4 | 8 |
| Gursave |   | 8 | 7 |
| Mustafa | ESL | 5 | 5 |
| Eric |   | 1 | 3 |
| Elijah |   | 6 | 1 |
| Jamil | EC | 1 | 1 |
| Saleh | ESL | 0 | 1 |

Discussion

The implications of this study and findings for my own practice are significant. I have learned that my students need repeated daily exposure to word problems and need to be forced to think about what they are doing in their thinking and why they made those decisions. I also need to continuously assess prior knowledge and concepts learned so that I can reteach certain skills when necessary. Most importantly, after discussing my research with my grade level team, we decided to try a new method of teaching in our grade level. We decided to group all the third graders homogenously and each teacher took one particular level of teaching (high, medium, low, etc.) so that we could review skills that students did not master and also to be better able to meet the needs of each child. Each of us spends about ten minutes each day on problem solving and reasoning skills. I also learned that I need to figure out what works for me as a teacher and also what strategies and methods work for my particular group of students. As stated by Henton, “each teacher must identify appropriate methodologies based on the nature of the subject matter to be covered, the anticipated effectiveness with a particular group of students, and the teacher's relative comfort level with the use of a given technique” (1979). I know that I have not completely answered my research question but I have started and plan to continue researching so that I can implement more strategies to help raise my student’s level of proficiency and mastery.

Implications for others’ practice is that problem solving requires multiple skills and you need to find out early in the school year which students use each skill effectively by giving pre and post assessments. Educators should push their students to think more about the problems they are trying to solve by asking many how and why questions. Providing many different methods and strategies for your students to try is necessary to figure out what will work best for each class and each student. Last, students need daily exposure to the types of problems they are struggling with so that they can continue to use the skills they are building. I strongly encourage classroom teachers to think about how they are teaching the skill their students struggle with and begin to research and discuss different strategies to implement. Knowing that each teacher is unique and each child is unique, will guide the research and will result in more effective teaching and better understanding.

References

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