**Lesson Plan 1: Problem Solving**

**(Caitlin Shanahan)**

**Date:** 10/24/12

**Subject:** Mathematics

**Grade Level:** Third Grade

**Intended of Duration Lesson**: 60 minutes

**State of Michigan Standards/Benchmarks:** .

Operations & Algebraic Thinking: Solve problems involving the four operations, and identify and explain patterns in arithmetic *(Taken from the Common Core State Standards for Mathematics).*

3.OA.8 Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

**Lesson Goal:**

The student will use problem-solving strategies to determine the appropriate arithmetic procedure to use in solving a given word problem. The student will apply rote arithmetic procedures to more complex learning and applications within the word problems.

**Lesson Objectives:**

1.) Given a word problem, the student will use effective problem solving strategies to identify an appropriate arithmetic procedure to solve word problems 2/2 times.

2.) Using the Educreations App, the students will verbally demonstrate their ability to adequately use the inner-language steps in at least 5/7 steps.

**IEP Goal/Objectives (if appropriate)**

Current Annual IEP Goal: Solve multi-digit math problems involving place value and properties of operations.

**Materials:** Provide a bulleted list

* White Board
* Problem Solvers Worksheet (one for each student)
* Manipulatives (to choose from): pencils, colored tiles, blocks
* Chart Paper with steps of “inner language” written out
* Educreations App on Ipad

**Prior Knowledge:**

* Students need to be familiar with basic arithmetic in order to apply those rote skills to solve a meaningful word problem.
* The students need to know how to use manipulatives, draw pictures, or write equations to solve the word problems.
* The students will need to be familiar with the scenarios in the word problems, including an understanding of vocabulary presented in the problem.
* Students need to know how to use Educreations independently

**Procedure:**

1. Students sit around half moon table in the resource room
2. Ask the students if any of them have ever had a problem outside of school that they used math to solve.
3. Let students share responses then ask then what kind of math they used to solve that problem.
4. For students who say they do not use math outside of school, give examples of when we use math.
5. Discuss with students how when we use math outside of school we have to decide how to solve the problem by choosing a method that works best for that situation.
6. Discuss how we do the same thing in school when we solve word problems, but sometimes we forget to look at the context of the story because we are so caught up on the answer.
7. Discuss how there are different ways we can solve problems depending on the context of that word problem.
8. Give students a sample problem. *Sample: Mike has 13 baseball cards. Sam has 22 baseball cards. How many more baseball cards does Sam have than Mike?*
9. Tell students they must solve the problem two ways, once using addition and once using subtraction.
10. Tell the students they can use any of the manipulatives on the table to solve the problem, but they have to be ready to share their answers.
11. Once students have solved the problem both ways, discuss if one procedure was easier than another.
12. Open up discussion for student’s to talk about why one way is easier or which procedure (addition or subtraction) they used first and why?
13. Talk about key words in the story problem and whether or not those key words helped us choose the best procedure or not.
14. Discuss how word problems are a lot like the problems we face in real life and we need to look at the context of the story to really understand what the question is asking us.
15. Talk about how solving problems is not only about finding the right answer, but choosing the best path to find that answer.
16. Introduce, “Inner-Language,” (Bley & Thornton, 2001, pg. 41). Tell students when we read story problems we can make a mental movie in our minds to imagine the actual story in the story problem.
17. Discuss how making a movie of the story problem will help us imagine how we might solve this problem in real life, and which method of solving the problem is best.
18. Show students chart paper with Inner-Language steps.
19. Read each step
    1. Step 1: Read the problem.
    2. Step 2: Either mentally picture the story problem, or actually draw a picture of what is happening.
    3. Step 3: Think: What is the question? What do I want to know when I finish the problem? Do I have enough info or do I need something else?
    4. Step 4: Is an exact answer required?
    5. Step 5: What operations is/are needed?
    6. Step 6: What is the best calculation method? Calculator? Mental math? Paper and pencil?
    7. Step 7: Check. Is the answer reasonable?
20. Model “Inner Language” by solving the previous sample problem.
    1. Read problem aloud
    2. Draw problem on board (as a story)
    3. Talk about what the question is asking (the difference between the two numbers)
    4. Discuss that the numbers are whole numbers so an exact answer is needed
    5. If you are finding the difference, maybe subtraction is the best operation to use
    6. The best calculation method is probably paper and pencil. Model how you can to that conclusion (calculator takes time to get out and mental math is not strong yet so I don’t want to rely on it).
    7. Discuss if the answer makes sense
21. Tell students that they are going to work in pairs now (put J and A (student names) together) and solve word problems using the Ipad App Educreations.
22. Tell them that they are going to model using the Inner Language to decide if their method for solving the word problem is a good one.
23. Tell the students that they can draw on the Ipad, use cubes, tiles, arithmetic, or any other method to solve the problems, but they must explain their thinking aloud while modeling the inner language discussed.
24. Tell them that the Ipad will record their thinking and methods used.
25. Tell the students that since the Ipad will be recording their voices, it is important to use the inner-language steps to help you solve the problem.
26. Remind students how to use Educreations (introduction to Educreations prior to this lesson).
27. Tell students that we should be able to watch the Educreations lessons and know exactly how the student solved the problem.
28. Give each pair a word problem to solve.
    1. *Group A (group with case study student who loves Mario): Joey wanted to buy the new Mario Wii game. The game costs $59.99. After saving his allowance, Joey has $38. How much more money does Joey need to save in order to be able to buy the new Wii game?*
    2. *Group B: Sam is visiting the apple orchard after school. He wants to get a donut for each of the 32 students in his class. The apple orchard has 65 total donuts to sell. After Sam buys a donut for each classmate, how many donuts will the apple orchard have left?*
29. Monitor student progress and thinking, remind students to use inner language.
30. Prompt students with questions to engage them in using problem solving skills.
31. Write down observation notes for each student; did each student demonstrate concrete, representational, or abstract knowledge of arithmetic operations? Did students demonstrate an ability to problem solve? Did the students consider more than one solution when solving the problem?
32. Once the pairs finish their Educreation lessons, watch the lessons back and discuss what similarities and differences were used in problem solving each word problem.
33. Discuss whether or not each problem called for an exact answer.
34. Ask students how we much use these problem-solving skills in real life. Give examples.
35. Collect Ipads and Educreation videos to use in assessing students problem-solving skills.

**Assessment:**

Two forms of informal assessments will be used during this lesson; observation and completion of a curriculum-based assessment, which involves using the Educreation app on the Ipad. Observation notes of each student will be taken during student work time on Educreation. Determining whether each student is at the concrete, representational, or abstract levels will be noted as well as the student’s use of inner language when problem solving. The curriculum-based assessment will involve reviewing each pair’s Educreation lesson to give credit for how well the student demonstrated use of problem solving strategies, as well as the accuracy of student work.

**Expansion:**

Video expansion: Students will work in pairs to solve a given word problem. The students will work together to physically act out the scenario in the word problem in a short skit or play. The skits will be video taped on the Ipad so that as a group we can watch, discuss, and compare the problem solving methods that took place. The videos can also be used as a method of expanded assessment. In the video, the students will be required to demonstrate the story in the word problem, as well as come to a solution to the problem. The skits allow the students to become part of the story and see how these problem-solving skills can be used in real-life applications. If one of the pairs of students in the lesson finishes the problem solving task quickly, they can do the expansion activity, and as a whole group we can watch the video back. If the other pair does not have time to do the video themselves, it will still be beneficial for them to see their peers acting out the scenario in the story problem.

**During the Lesson:**

At the beginning of the lesson, Joseph (pseudo name) needed a lot of redirection and prompting to answer my initial question about where we use math outside of school. In the, *Student Attitude Survey*, given as part of my Assessment Report, Joseph mentioned that he uses math outside of school when he buys things such as the new Mario Wii. In knowing this, I was able to prompt Joseph to think about how he used math in that situation. This got his attention and he definitely showed more interest in the lesson from that point on. When I presented the sample question to the group I paid close attention to Joseph and noticed that he grabbed for the cube manipulatives right away. He first solved the problem using subtraction. After he found the answer, I had to prompt him to try to solve the problem using addition. He insisted that he had already found the answer so it wasn’t important to try to solve it a different way. After prompting him some more he attempted to solve the problem using addition, but struggled to come to a solution. I decided to open up the discussion and allow everyone to share their results. I noticed that all four students solved the problem using subtraction first, so I called on Joseph initially to build his confidence and encourage participation. Joseph had a hard time communicating his results to the other students so I helped him with some prompting and questioning. I put the cubes in front of him and told him to show how he used them to solve the problem. From there he did well and others began talking about how they used the same method as well. We spent the next ten minutes looking at different subtraction and addition procedures that were used and talking about their differences and similarities, as well as what method worked best. During the discussion Joseph was getting off task and looked very tired. He put his head down on the table three times and appeared very uninterested. When I introduced the inner-language model I stood up and moved around the room to keep his attention on me. Once I mentioned that we would be using Ipad’s today he perked right up and got very excited. I told him he had to understand how to use inner-language in order to do the Ipad activity, which made a difference in how much he was attending to the lesson.

Joseph showed a lot of enthusiasm when I presented the question to him and his partner. His question was presented with the important information bolded so he knew that he should be paying attention to that information. At first, Joseph began talking about Mario Cart and how he was going to buy the new game soon, which is something he talks about a lot, and usually becomes a distraction. I redirected Joseph’s attention back to the word problem, specifically the math part of the problem, and reminded him again of the task at hand. Joseph struggled at first to model inner-language so I had to prompt him. Eventually he began to use inner-language to solve the problem. I reinforced his behavior with positive supports and praise.

Joseph used drawings to solve his problem and actually drew out the scene of buying the Mario Wii game. He used subtraction to solve the problem (much like he did on the sample problem). Again, he struggled to see how addition could be used to solve the problem even after it was discussed with the whole group. To support his thinking, I brought out the manipulatives (cubes) and together we physically moved cubes to model using addition to solve the problem. Using manipulatives helped Joseph make much more sense of the problem.

Near the end of the lesson Joseph asked if addition and subtraction can always be used together in word problems. I opened up discussion for the other students to answer his question. A couple of students said it depends on the story problem. From here I talked about how there can be more than one way to solve a problem so we need to start looking at what the question is asking us rather than just doing it one way. I made direct reference to the discussion we had at the beginning of the lesson in which we talked about how we use math in our daily lives.

**Extensive Reflection:**

One of the common learning characteristics that make mathematics difficult for struggling learners is called passive learning (Allsopp, 2007, pg. 50). Based on my observations of Joseph, he rarely looks for connections between what he already knows and the new information he is learning. Because of this, Joseph has difficulty implementing strategies or activating previous knowledge when he is presented with a problem-solving situation. Allsopp suggests that, “Embedding mathematical instruction in relevant authentic contexts and encouraging students to develop and consider several strategies to complete a task will help these students make important connections,” (Allsopp, 2007, pg 51). In other words, to encourage Joseph to become a more active learner I wanted to create a lesson that teaches him to use problem-solving strategies to solve word problems involving basic arithmetic operations.

As indicated in the Assessment Report (see note below), Joseph struggles to apply his knowledge of rote arithmetic skills in more complex applications such as word problems. In creating word problems for this lesson that mimic real-life situations, Joseph is able to learn problem solving strategies using a context that is relevant to Joseph’s life. In his Assessment Report, the Student Attitude Survey indicates that Joseph has a narrow view of how math can be applied to other areas of his life across settings both inside and outside of school. Joseph views math as a discrete subject in school, therefore he does not view it as a meaningful part of everyday life. Bley & Thornton explained that, “The need to use reasoning skills and to evaluate situations permeates one’s life,” (Bley & Thornton, 2001, pg. 33), therefore it is a necessary skill for Joseph to develop. Using context that is relevant to Joseph’s life helped him connect to this lesson. The hope is that Joseph will use the problem solving strategies introduced in this lesson not only on his general education math assignments, but in more meaningful contexts outside of school as well.

Overall, the lesson implementation was successful. Although there were moments where Joseph seemed bored or distracted, he participated in the lesson more than he typically has in past lessons. The technology piece was an important part of this lesson because it kept him engaged and made him excited to try the new strategies he learned. Although Joseph’s participation was lacking in the beginning of the lesson, he was fully involved in using the Educreation app to solve the word problem using the inner-language steps. In reflecting on the overall success of the lesson, I think it would have been more beneficial to mention the Ipad activity in the beginning of the lesson to get all the students excited right away. I was not very clear as to what my expectations were from the beginning of the lesson, which I think would have encouraged Joseph to get involved initially. During the discussion aspects of the lesson Joseph was much less engaged and required more redirection than he did once the Ipad’s were brought out. By telling the students initially that we would be doing an Ipad activity later in the lesson, Joseph might have been more attentive during discussion.

An accommodation that was made for Joseph during this lesson was in the presenting of his word problem. Joseph demonstrates selective attention and can not easily discern between important information and unimportant information in a word problem. This was demonstrated on a previous assessment in which Joseph was asked to pick out the information in a word problem that was unimportant. He could not do this task even with prompting. In knowing this, I bolded the important pieces of information in the story problem task he had to work on. Also, because I choose to write his story problem using the Mario Wii game as the context, I was concerned that Joseph would be overly focused on Mario and pay less attention to the math task. By having the words bolded already, Joseph was able to visually see which information he should be focused on. One accommodation that I wish I had thought about before the lesson was to have visual cues that indicated each step of the inner-language strategies. Allsopp suggests that providing visual, tactile, or auditory cues to highlight the relevant features of a concept is a helpful teaching technique for students who display attention difficulties (Allsopp, 2007, Pg 54). While I did anticipate that Joseph’s lack of attention would be problematic during this lesson, I did not provide enough accommodations to support him.

In the area of assessment, I felt my assessment methods were appropriate for this lesson. While the students were working on the Educreation portion of the lesson, I took observation notes on the discussions and actions of each student. By having the informal observation notes along with reviewing the Educreation lessons the student’s created, I obtained an adequate understanding of student learning. Joseph demonstrated the first two steps of inner-language without prompting. He chose to draw the story problem out on his Educreation whiteboard, however he spent too much time adding to the drawing rather than looking at the math portion of the story problem. I had to redirect his attention a couple of times by pointing to the next step on the inner-language chart. Again, I think having visual or auditory cues would have helped him move more independently through the inner-language steps. In looking at the objectives for the lesson, Joseph demonstrated the ability to use 6/7 inner-language steps, however he did not consider using different procedures to solve the problem. Instead he immediately solved the problem using subtraction, which is similar to the procedure method he used in the sample question. I should have been more explicit in telling Joseph that I wanted him to consider multiple methods for solving the problem in order to urge him to explore more reasoning skills.

As a follow up lesson, it would be beneficial to continue to encourage Joseph to use his problem solving skills in a variety of ways and contexts. I think Joseph needs to continue to develop confidence in exploring different procedures and methods to solving word problems. The inner-language model is not meant to be thought of as individual procedural steps, but rather should become an internalized tool used in problem-solving situations both inside and outside of the classroom. Joseph will need more practice using this problem-solving strategy by looking at different word problems that involve using a variety of operations. Furthermore, I think it would be helpful to create a lesson in which Joseph has to determine whether or not an exact answer is necessary. Based on observations during this lesson, and lessons in the past, Joseph tends to focus more on finding one right answer rather than exploring different pathways. In order to transfer the problem-solving skills Joseph saw in this lesson to more meaningful contexts, he needs to see how they can be used in situations he encounters on a daily basis. Joseph, as well as other students with disabilities, need to understand the meaning of each operation, so that they can decide which operation is needed in a particular situation in life (Ashlock, pg 7). In follow up lessons, I think it’s important to incorporate math problems that ask Joseph to consider different operations, rather than just looking for one answer.

*Note: I did not include problem solving as a weakness of my case study student before submitting the Assessment Report. However, after reading Bley & Thornton Ch 2, I began to notice that my student struggled to apply arithmetic operations to more complex situations using problem-solving strategies. This was discussed via email to Madison and she recommended that I create an assessment that addresses this concern. To examine his problem solving skills, I created a worksheet with several word problems that were presented one at a time to my student in a one-on-one situation. Using observation notes, I was able to record the methods my student used. In reviewing this assessment, it became clear that my case study student struggles to solve two-step word problems, as well as consider multiple procedures for problem solving. Although he has demonstrated an ability to solve rote arithmetic equations, this student struggles to apply those procedures when problem solving. Below is a copy of the assessment with my observation notes.*

*References:*

Allsopp, D, Kyger M, and Lovin, L. (2007). Teaching Mathematics Meaningfully: Solutions for Reaching Struggling Learners. Baltimore: Paul H. Brookes Publishing

Ashlock, R. *Error patterns in computation*. (Tenth ed., p. 7). Allyn & Bacon.

Bley, S. & Thornton, N. (2001). *Teaching Mathematics to Students with Learning Disabilities*. Austin, TX: Pro Ed Publishing

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