

# Sentence Frames in the Elementary Math Classroom

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### Introduction

I am a fourth year teacher in my third year of teaching 3<sup>rd</sup> grade. I teach in a predominately white community containing many low income families with low expectations, little support, and poor study skills for their students. I am by no means a veteran teacher, but in the years I have taught, I have tried many different strategies for helping students understand mathematics. However, there still seems to be a divide between the students who understand math and the ones that don't. Even my students that appear to understand the material cannot explain to me how they came to their answer or what their reasoning was. At times I attributed this to them not trying to be successful, or setting themselves up for failure because they did not think they could solve a problem and therefore wouldn't try to. I also thought they might be lacking basic skills that enabled them to solve problems or the mathematical language skills to explain what they were doing.

I have noticed that if a student is unsure of an answer or does not want to do a problem they will wait until someone gives them the answer. I have been guilty of this in the past because I felt rushed for time and discouraged that students were not volunteering. Also, many of my students are very vocal during math time and tend to blurt out answers, so struggling students have gotten used to waiting for someone else to figure the answer out for them. I want to put a stop to this because it is clear to me that my students do not have confidence in their understanding of math work without me holding their hand through the whole thing. They do not try to figure out problems that confuse them and they give up on problems that they think look too hard. Even if they know how to solve the problem they need me there reassuring them in order to complete it. Rather than using reasoning skills and persevering through the problem they are "jumping ship" at the first sign of trouble.

In an attempt to help our students reach a deeper understanding of mathematical concepts my school district asked the teachers to reevaluate the curriculum and adapt it to focus on covering fewer concepts with more depth. These concepts have been aligned throughout the grade levels so gaps do not appear in our instruction. We also have the common core standards for mathematics that will be adopted in the next year or so. These standards emphasize the importance of using reason to solve, make sense of, and persevering through mathematical problems. Since these are all areas my students struggle in I wanted to use my action research project to introduce something that would support them as well as give them a framework they could use in future problem solving situations.

These problems all led me to brainstorm options for increasing student understanding, ability to explain their thinking, and confidence in the classroom. While speaking with a fellow teacher I learned about strategies she used in her classroom that helped develop these areas. She is a high school mathematics teacher in California with a high population of Hispanic students. Her students are able to understand the process of mathematics, however, they are not able to explain their thinking well because of their language barrier. My friend mentioned that sentence frames, while intended for English Language Learners (ELL), work to support students by giving them a structure of what they are expected to know and the format they should use to explain their answers. This gives them more confidence in their answers because they can easily determine the next step as well as the proper phrasing for their answer. Although these were meant for ELL students, I believed they could be tailored to meet the needs of my general education math students. I wanted to see if my third graders would be able to solve story problems or other math problems on their own if they had a support structure and detailed steps to follow. I wondered if students would be able to show understanding without my assistance if

they persevered and had more confidence in themselves and their ability to solve mathematics problems. I also hoped, after time, that students would internalize the mathematical structure of these problems and be able to utilize them in the future.

### **Math Questions**

The questions in this investigation were:

- Will students better understand the steps to a math problem if they are given a sentence structure for their answers?
- Will students be able to apply the sentence structure to new problems and persevere to solve them?
- Will using sentence frames for third grade material help students to better understand the mathematical terms discussed?

### **Literature Review**

While researching information for this project I came across very few studies that tested the effectiveness of sentence frames in ELL classrooms and none that were in mathematics classrooms or used with general education students. However, there were many articles written on this subject, by educators and others from the mathematics community, that supported the use of sentence frames in math classrooms. According to an article written for Instructor magazine titled, “10 Ways to help ELLs Succeed in Math,” “Sentence frames support students in math discussions, give meaning to vocabulary, and allow English Language Learners the practice they need to explain their thinking about mathematics (Willig, Bresser, Melanese, Sphar, Felux, 2010,

p.28).” Although my students are mostly native English speakers, they still need support in math discussions, need to understand vocabulary and need practice explaining their thinking about mathematics. CSCOPE is a k-12 curriculum designed and used in Texas. They create newsletters periodically, written for teachers, to assist them in problems they may be facing in the classroom. The newsletter I found about sentence frames came from their 3rd six week edition from 2008-2009. It stated, “Research tells us that readers need to know 90% to 95% of vocabulary in a text in order to understand it. This sentence frame strategy provides temporary assistance so the learner will later be able to complete a similar task alone in the future. All students will benefit from sentence frames, but we must purposefully plan for our ELL students (Gautier p.2).”

Susan Carter, a teacher in St. Louis, MO did an action research project of her own, where she looked at the benefit of introducing writing journals into math lessons. In her research she used the same sentence frames over and over in group discussions to give students a structure for writing about what they were thinking in math. According to one of her resources, “Think-alouds like these help students to visualize mental processes that would otherwise be invisible (Wilhelm 2001).” She used these think-alouds with sentence frames as opportunities to let the students learn from each other. She stated, “Students can sometimes explain concepts to one another in a way that may not have occurred to me because they use examples that make sense to them (p. 608).”

The rest of my resources were designed to help someone create and implement sentence frames in the classroom. In article titled, “Using Sentence Frames to Develop Academic Vocabulary for English Learners,” authors Donnelly and Roe explain, “To develop sentence frames, first write sentences that express the target language function (e.g., compare/contrast),

then replace target vocabulary with blanks (2010 p. 132).” They break the sentence frames in to Tiers 1-3 with 1 being the most simplistic and 3 being the most advanced level. They go on to say, “Knowing how to include explicit ELD [English-language development] in content area instruction will not only enhance students’ comprehension but also build necessary language skills and vocabulary to increase students’ content knowledge (2010 p. 135)

### **Data Collection**

This research project was administered in a classroom of 21 third grade students in Potterville Michigan. The class has 11 boys and 10 girls and the students range in age from 8-10. There’s a great diversity of abilities in my classroom, especially in reading. This was one of the reasons why giving support for solving and explaining problems was so important to me and my project. Although the class size is small, there are many behavioral issues that need to be dealt with on a daily basis such as talking, disrespectful behavior, and lack of attention. These issues impede my ability to teach and at times made it difficult to get accurate results from my project. Over the course of a month I taught mathematics in a traditional manner and assessed the students, then taught the students multiples lessons using sentence frames I created in conjunction with our curriculum. Next, I assessed the students again to see what gains, if any, they had made. During the process of my project I found it necessary to rewrite the sentence frames to clarify some confusion the originals had created.

I used multiple forms of data to test my questions. To set a baseline for my research I taught a third grade unit on number sense. I used the chapter test from this unit to determine areas of student weakness. I then used the test to write sentence frames for each of the concepts students struggled with. The sentence frames were designed to help students understand

mathematical vocabulary, as well as give them a problem solving structure to follow independently. I wrote the frames as if I were solving the problems out loud and thinking through them, to show the steps I used. While teaching the students how to use the sentence frames I recorded them using a small camcorder hidden from view. I wanted to get a candid shot of the classroom to see if the other factors I mentioned earlier could have contributed to my results and also to give me a different perspective of my classroom. Since I knew that behavior was an issue I wanted to see if the sentence frames helped, were neutral, or made the situation worse.

After the lesson I had students resubmit their tests with their answers from the sentence frames. My initial feedback from the students was mixed, with many saying that the strategy confused them, so I decided to teach another lesson with a more simplified sentence structure. It involved less of the “think aloud” process I had used on the last one. I also included a student survey on the back of the assignment. That enabled me to get a better sense of what the students were thinking and feeling about the sentence frames after using them. I video taped the lesson as well as conversations I had with students while they were working on their assignments. The students knew they were being taped this time because they saw me moving the camera around.

### **Data Analysis**

The baseline math assessment results were rather poor, with less than half of the class receiving a benchmark score of 80% or better. Many of the students were making mistakes in the same areas of estimation, patterns, and story problems. There were also a great number of students that left areas of the test blank because they did not understand how to complete it and were not able to get enough help from me. I took the test problems that students did poorly on

and turned them into sentence frames (Student Test in figure 1). Each sentence gave students the structure and steps they would need to solve the problem. When students had been shown how to use the sentence frames they appeared to better understand the material and how it was broken down. During the part of the test that asked students to estimate and describe a number pattern the class scored significantly higher on the post assessment than on the original task (Example of Sentence Frames in Figure 2). 17 out of 21 students filled in the sentence frames and answered these questions correctly. That compares to the previous 9 students who answered them correctly using the traditional method.

The sentence frames could not be called a complete success, however, because the story problems had a range of results. Some students filled in the sentence frame correctly, but still came to an incorrect answer. Others did not seem to understand the phrasing of the frames and filled them out the wrong way, resulting in a wrong answer. Still others seemed to understand it and come to the correct conclusion using the frames. In addition to this, the verbal feedback from students was overwhelming. The comments being shared with me during and after this activity were, “I don’t get this,” “I need help,” “What does this mean?” “What goes on this line?” and, “This is confusing.” No one was able to tell me that they felt it was beneficial to use sentence frames, even though many of them were able to get the correct answers using them.

In the second activity I restructured the frames to be less of the think-aloud style Susan Carter spoke of in her article, “Connecting Mathematics and Writing Workshop: It’s Kinda Like Ice Skating.” The new sentence frames were more basic and simple sentences (Figure 3).

Although the students still seemed to ask me a lot of questions and say, “I don’t get this,” they were able to work through the frames very well. Most of them were able to work alone or in pairs without assistance. Almost everyone was confused by the third question on the page and



after review of the wording I re-wrote it for everyone on the board. Even a student who was absent for the previous activity was able to complete the assignment once I fixed the wording of that problem. (The corrected Sentence is below figure 3).

Another form of data collected was the video recordings I made of the lessons. When watching the lessons there were some common items I noticed across the movies. First, the students still looked to me to lead them in the activity and did not try to persevere through the problems by using the sentence frames. This sometimes appeared to be because they didn't understand how to use the frames and other times because they wanted me to give them the answer. This is something that would have to be studied for a longer amount of time to determine if there were any correlations between sentence frame use and perseverance in difficult problems.

On a more positive note, in the first video the students seemed to be more confused than in the second. This is where I had used the more simplified sentence frames. In the student conferences I was able to help students use the sentence frames to arrive at the correct answer with a limited amount of information from me. I was able to steer them in the right direction with questions about their thinking, rather than giving them answers. I directed them to use their book and the frames to solve their problem, which was enough guidance for most of the students.

I also noticed, in the feedback students gave me, more than half the class thought sentence frames were "helpful," but only 7 said they thought using sentence frames would help them solve problems "always." Most students selected "sometimes" and that they were "not helpful" in solving problems. The top students in my class, who knew most of the information going into this project, were mixed in their opinions as well. At times the sentence frames

confused them and in other cases they felt it was a waste of time because they already knew how to solve the problems.

Although there is evidence in my literature review and in some of the data I collected to support the use of sentence frames in the math classroom, I cannot give a definitive answer one way or another. When I created sentence frames they made sense to me, but sometimes the students didn't understand them. Continued honing will need to be done to find a suitable format for using sentence frames in my class in the future.

### **Conclusion**

In a way I learned a great deal from this project, but not in the way I had originally intended. I think I went about this project in the wrong way when bringing it into the classroom. Ultimately my goal was to give students a structure for solving problems that could be broken down into manageable steps they would be able to complete on their own. I wanted to make my thinking visible to them so they could follow the thought process and persevere to solve a problem that they didn't know the answer to. However, what I found was, the more procedural I tried to make the sentence frames the more my students got confused. The steps were too wordy and they ended up detracting from the math the students were trying to learn. It especially seemed to mix up my students who already had a strategy for solving story problems. I found that just as many students asked questions, but some of that was because they didn't seem to understand how to make their thinking fit with the sentence frames I gave them. I think one of the reasons this did not work the way I had hoped was because the original sentence frames were designed for English Language Learners as a way to bridge mathematics and the English language. Most of these students already understood how to do mathematics, but were having

difficulty expressing their answers. My students didn't know how to do the math part of the problems either. All of the sentence frame examples I found were very simple and short. I didn't think these would give my students the steps they needed to solve the story problems they were working with, so I made them more complex. Maybe sentence frames are not suited for story problems because of how wordy they are.

Another idea that came to mind had to do with the way I wrote the sentence frames. I was writing them using the thought processes I go through to solve a problem, however, I have a much more advanced understanding of mathematics than my students do. I think it would be beneficial to speak with students who understand a problem and have them explain how they would solve it. Then I could use that information to write new sentence frames. Susan Carter mentioned that she thought students could sometimes learn better from each other than from the teacher because they understood the examples other students gave. I think this could be one of those situations. Going along with this idea, I think that I would like to try sentence frames in conjunction with partner and group work. Although this was not one of my original intentions of this investigation, I noticed that the sentence frames sparked conversations between students who were working together. The frames seemed to give students a common platform to discuss and help each other understand. My students also seemed much more engaged and motivated to solve these problems when they were allowed to converse with a partner.

I have realized that writing sentence frames is a lot more difficult than I had previously thought. I would spend upwards of 10 minutes writing, erasing, and re-writing the frames for one story problem. They never seemed to come out right the first few times I would write them. Even when I thought they were well written I would sit down with the kids to discuss them and realize that it was still confusing. I am not going to give up on my use of sentence frames in

math, but I am going to keep trying different formats until I find something that the students and I both like. I may try to make the sentence frames more discussion based, rather than written.

Also, Susan Carter used her sentence frames as phrases that became routines because they were used over and over. I think incorporating sentence frames into discussions that way would make it possible to reach my goal of giving students strategies they could take with them. I am not ready to share my findings with my colleagues, but I am also not ready to give up on using sentence frames in the classroom.

The links to my classroom videos can be found at the following links:

<http://www.youtube.com/watch?v=HuOpMBwMtyY>

<http://www.youtube.com/watch?v=y9EEOhXoDRI>

[http://www.youtube.com/watch?v=m\\_zTEIDC1Jg](http://www.youtube.com/watch?v=m_zTEIDC1Jg)

<http://www.youtube.com/watch?v=kcthmDFfmjY>

## Works Cited

- Carter, S. (2009). Connecting Mathematics and Writing Workshop: It's Kinda Like Ice Skating. *The Reading Teacher*, 62(7), 606–610.
- Donnelly, W., Roe, C. (2010). Using Sentence Frames to Develop Academic Vocabulary for English Learners. *The Reading Teacher*, 64(2), pp. 131–136
- Gautier, C. (2008-2009). Supporting Student Learning Through Use of Sentence Frames. *CSCOPE*, 1-6.
- Wilhelm, J. (2001). Think-alouds: Boost reading comprehension. *Instructor*, 111(4), 26–28.
- Willig, C., Bresser, R., Melanese, K., Sphar, C., Felux, C. (Mar/Apr 2010). 10 Ways to help ELLs Succeed in Math. *Instructor*, 119, 27-29.

Figure 1- Student Test

Chapter 2 Test Form A: Mixed Formats

MULTIPLE CHOICE

Circle the letter of the correct answer.

1. What is the missing number in  $6 + \square = 15$ ?

- A. 6                      C. 8  
B. 7                      D. 9

2. Which is the most reasonable estimate for  $707 - 413$ ?

- A. 100                      C. 300  
B. 200                      D. 400

3. What is the missing number in  $6 + \square + 7 = 15$ ?

- A. 1                      C. 5  
B. 2                      D. 6

4. Find  $36 + 48$  using mental math.

- A. 76                      C. 84  
B. 83                      D. 85

5. Find  $34 + 9$  using mental math.

- A. 38                      C. 43  
B. 40                      D. 44

6. Round to the nearest ten to estimate  $153 + 134$ .

- A. 260                      C. 280  
B. 270                      D. 290

7. Round to the nearest hundred to estimate  $273 + 364$ .

- A. 700                      C. 800  
B. 750                      D. 850

8. Which number sentence is NOT a part of the fact family for  $7 + 6 = 13$ ?

- A.  $13 - 7 = 6$   
B.  $13 - 6 = 7$   
C.  $6 + 7 = 13$   
D.  $13 + 7 = 20$

9. What number would complete the table?

In	4	7	2	5	6
Out	10	13	8	<input type="checkbox"/>	12

- A. 6                      C. 11  
B. 10                      D. 16

10. Ricardo has \$16 to spend. He buys a basketball that costs \$9. How much does he have left over? Find the number sentence you could use to solve the problem.

- A.  $\$16 - \$9 = n$   
B.  $\$16 + \$9 = n$

11. Mia had 15 yogurt bars for her party. The guests ate 9 of the yogurt bars. How many did she have left?

- A. 24                      C. 7  
B. 9                      D. 6

FREE RESPONSE

Estimate each sum. Then tell whether each estimate is an overestimate or an underestimate.

12.  $21 + 32 = 58$   
under

13.  $56 + 29 = 90$   
over

Find each sum using mental math.

14.  $32 + 46 = 80$

15.  $58 + 34 = 90$

Complete each fact family.

16.  $6 + 8 = 14$   
 $8 + 6 = 14$

$14 - 6 = 8$

$14 - 8 = 6$

17.  $4 + 3 = 7$

$3 + 4 = 7$

$7 - 4 = 3$

$7 - 3 = 4$

18. Write the fact family for 7, 8, and 15.

$8 + 7 = 15$      $8 + 7 = 15$   
 $15 - 7 = 8$      $15 - 8 = 7$

Find each difference using mental math.

19.  $71 - 48$  \_\_\_\_\_

20.  $86 - 35$  \_\_\_\_\_

21.  $34 - 20$  \_\_\_\_\_

22.  $56 - 32$  \_\_\_\_\_

Round to the nearest hundred to estimate each difference.

23.  $671 - 98 = 600$

24.  $386 - 221 = 200$

Round to the nearest ten to estimate each sum.

25.  $6 + 87 = 100$

26.  $47 + 118 = 170$

their ball team. Maggie sold 5 of the magazine subscriptions. How many did Sarah sell? Explain how you got your answer.

7. I put 5 fingers then counted to 12.

October. He completed 112 cars in November. Did he make enough cars? Estimate. Write a similar problem for a friend to solve.

No, he did not make as much as he wanted to but he made more.

**WRITING IN MATH**

28. Timothy threw a football down the field. First he threw the ball 20 feet. Then he threw it another 30 feet. Did Timothy throw the ball 50 feet in all? Estimate to decide. Explain how you estimated.

No, I estimated to the nearest 10 then add them up and I got 50.

30. Look for the pattern. Describe the rule and write the missing numbers to complete the table. Then create your own table that follows a rule.

In	16	8	10	12	9
Out	8	0	2	4	1

in	2	20	30	4	7
out	1	19	29	3	9

Figure 2- Sentence Frames

**Reasonable estimate # 2**

My first number rounds to 100  
 My second number rounds to 400  
 When I subtract these I get  $100 - 400 = 300$ .

**Completing a table #9**

The numbers coming out of the table are larger (smaller/larger) than the numbers going in.  
 This means that I need to add. (add/ subtract)  
 The change from my IN to my OUT is 6.  
 This means that my rule is +6.  
 I find my missing number by solving  $5 + \text{ } = 11$ .  
 The missing number is 11.

**Estimating a sum #12 and 13**

My first number rounds to 20. That is an under estimate.  
 My second number rounds to 30. That is an under estimate.  
 When I add these together I get 50. It is an under estimate.

**Rounding to the nearest ten # 25-26**

1<sup>st</sup> number: The number in the tens place is 0. It will round to 10.  
 2<sup>nd</sup> number: The number in the tens place is 8. It will round to 90.  
 When I add these I get  $10 + 90 = 100$ .

**Story Problem #27**

The question I am trying to answer is how many did Sarah sell?  
12 Subscriptions were sold by both girls.  
 Maggie sold 5 subscriptions.  
 To find out what part of the subscriptions Sarah sold I need to subtract.  
 I find my answer by solving  $12 - 5 = 7$ .  
 Sarah sold 7 subscriptions.

**Story Problem #28**

The question I am trying to answer is a story problem?  
 Timothy's first throw rounds to 20.  
 His second throw rounds to 30.  
 To solve this problem I need to estimate.  
 My problem is  $20 + 30 = 50$ .  
 The answer to my question is no.  
 Because he did not make 60 feet in all.

**Story Problem # 29**

The question I am solving is Martin's model cars?  
 Martin wants to make 250 model cars.  
 When I estimate, in October he made 128 cars.  
 When I estimate, in November he made 112 cars.  
 Since I want to know how many cars he made altogether I need to estimate.  
 My number sentence is  $250 + 112 = 330$ .  
 Martin made 330 cars.  
 The answer to my question is no but he made more than he wanted.

**Completing a table #30**

The numbers coming out of the table are smaller (smaller/larger) than the numbers going in.  
 This means that I need to subtract. (add/ subtract)  
 The change from my IN to my OUT is 8.  
 This means that my rule is 8.  
 I find my missing number by solving  $8 - \text{ } = 8$  and  $12 - 4 = 8$ .  
 The missing numbers are 0 and 4.



Figure 3- Second set of Sentence Frames and Student Survey

Name \_\_\_\_\_

Sentence frames for story problems Pg. 141- 142 #1-6

1) Jeff has 3 choices for white bread and 3 choices for rye bread.  
 Jeff can choose from 6 Sandwiches.

2) The pattern for Allie's necklace is 4 red beads, then 2 blue beads.  
 When Allie has used 8 red beads she will have used 4 blue beads.  
 When she has used 12 red beads she will have used 6 blue beads.  
 When she has used 6 blue beads she will have used 12 red beads.  
RRRRBBRRRRBBRRRRBB

3) When Ted gets 3 carrot sticks, Ben gets 6.  
 When Ted has 6 Ben will have 12.  
 When Ben gets to 6 carrot sticks, Ted will have 3.

4) The pattern for Karen's necklace is 5 red beads, then 1 white beads.  
 When Karen has 10 red beads she will have 2 white beads.  
 When she has 15 red beads she will have 3 white beads.  
 When Kareh has 15 red beads she will have 3 white beads.

5) Tara gave friendship bracelets to Anna and Ellie.  
 Anna gave bracelets to Tara and Ellie.  
 Ellie gave bracelets to Tara and Anna.  
6 bracelets were given in all.

6) The children are in this order...  
Emma Jay Ryan Lisa  
 First Second Third Fourth

Name \_\_\_\_\_

1) I thought the sentence frames were ...  
 helpful 😊  didn't help 😐  more confusing ☹️

2) I think using sentence frames will help me solve problems...  
 Always 😊  Sometimes 😊  Never ☹️

3) This way of solving problems make me like math...  
 More 😊  the same 😐  less ☹️

I thought they  
 kinda helped but  
 some of them where  
 more confusing  
 but some of them  
 helped. I love you

3) When Ted gets \_\_\_ carrot sticks, Ben gets \_\_\_. If they each get another set, Ted will have \_\_\_ and Ben will have \_\_\_. If they get another set, Ted will have \_\_\_ and Ben will have \_\_\_. That means, when Ben gets to 6 carrot sticks, Ted will have \_\_\_.

