GRADE 10 MATHEMATICS: Interpreting Word Problems

Summary of Learning Opportunity

In the past, I have always just jumped into teaching the different ways of solving systems of linear equations. In my experience, most students feel confused and anxious when we get to word problems. This year, we focused on interpreting contextualized problems from a literacy perspective. We even invited the Secondary Literacy Coordinator to support the initial lesson. Rather than teaching methods and tricks, we used reading strategies to help students approach and understand the word problem text and the context of the question before identifying the unknowns in the question. Students found ways to use linear equations to interrelate the information presented in each question. Although this process took two entire classes, students were much more engaged and less anxious when it was time to work on word problems independently. Students tracked their own growth and reflected on their ability to understand word problems throughout the unit. By the end of the unit, many students demonstrated understanding beyond the proficient level. Students could clearly communicate their thinking process and justify their solution. Most importantly, students were also able to interpret the solution in context and think "Does this make sense?", which used to be a sticking point in the past. Overall, students and teachers were all very satisfied with their progress in this unit.

Mathematics 10	**Learning Standards**	**Reasoning and modeling** • Model with mathematics in situational contexts **Understanding and solving** • Apply flexible and strategic approaches to solve problems • Solve problems with persistence and a positive disposition **Connecting and reflecting** • Reflect on mathematical thinking • Use mistakes as opportunities to advance learning

Literacy Connections	Instruction and Assessment	Competencies Developed and Practiced
LITERACY: Comprehends texts—Interprets texts, Makes connections	1. We invited our district's Secondary Literacy Coordinator to work with the students on reading comprehension strategies. Students practiced reading questions aloud in pairs, to each other. This encouraged them to slow down and spend more time understanding the context of each question. In pairs, students summarized the question in ten words, discussed the context and unfamiliar vocabulary words, and connected problems to ones they had previously seen. Then, together, students extracted information from the problem, including deciding on the knowns and unknowns. 2. We spent the next few class periods learning three strategies to solve linear systems in various situations: by graphing, substitution and elimination. Students evaluated the pros and cons of each method and practiced identifying which method is most suitable in a variety of situations. Some students came to have preferred methods for solving systems of equations. 3. We also worked with students to explain and justify their process and solution when solving word problems. For example, students learned to verify their solution by substituting the ordered pair for the solution into the system to see whether both linear equations held true. We taught students to ask themselves if the solution made sense in the context of the problem.	• Model with mathematics in situational contexts • Apply flexible and strategic approaches to solve problems • Solve problems with persistence and a positive disposition • Reflect on mathematical thinking • Use mistakes as opportunities to advance learning

Demonstrations of Student Learning, Teacher Assessment and Reflection

Pre-Activity Reflection: In a short paragraph of two to four sentences, describe your view of word problems. Please include your likes, dislikes, and/or your hesitations.

Word problems, in my opinion, are tricky but once I understand them, I find them helpful. For example, sometimes I find that word problems help me understand equations more, because it is taking the math, and putting it in day to day scenarios. However sometimes I find them hard to understand. Especially in this unit, I don't understand how to solve these questions.

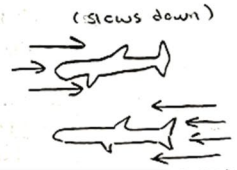
Partner reading:

- Partner A reads the first section of text aloud. Partner B follows along and helps to solve any tricky words and provide corrective feedback.
- Partner B reads the same section of text aloud. Partner A follows along and helps to solve any tricky words and provide corrective feedback.
- Work together to summarize this section of the text in 10 words or less:
  - Hold up 10 fingers.
  - Put a finger down for every word used.
- With your partner, answer the reflective questions.

1. **With a tailwind, a particular airplane travels at 420 km/h. When flying against the wind, the airplane can travel at only 310 km/h. Let the airplane's speed in still air be *v* kilometres per hour. Let the wind speed be *w* kilometres per hour. Use a system of linear equations to represent this information. Determine the wind speed and the speed of the plane in still air.**

What is this question asking you to do?
Determine wind speed and still air speed of the plane.

What do you need to know to answer this question?
- Regular speed of the plane WITH TAILWIND (420 km/h)
- The speed of the plane against the wind (310 km/h)
- What is tailwind → wind that pushes you forward



Post Activity Reflection: In a short paragraph of two to four sentences, describe your perspective of word problems now. At first, these word problems didn't make much sense, and I had found them very difficult and confusing. After this unit, I feel very confident in correctly answering word problems

Pre-Activity Reflection: In a short paragraph of two to four sentences, describe your view of word problems. Please include your likes, dislikes, and/or your hesitations.

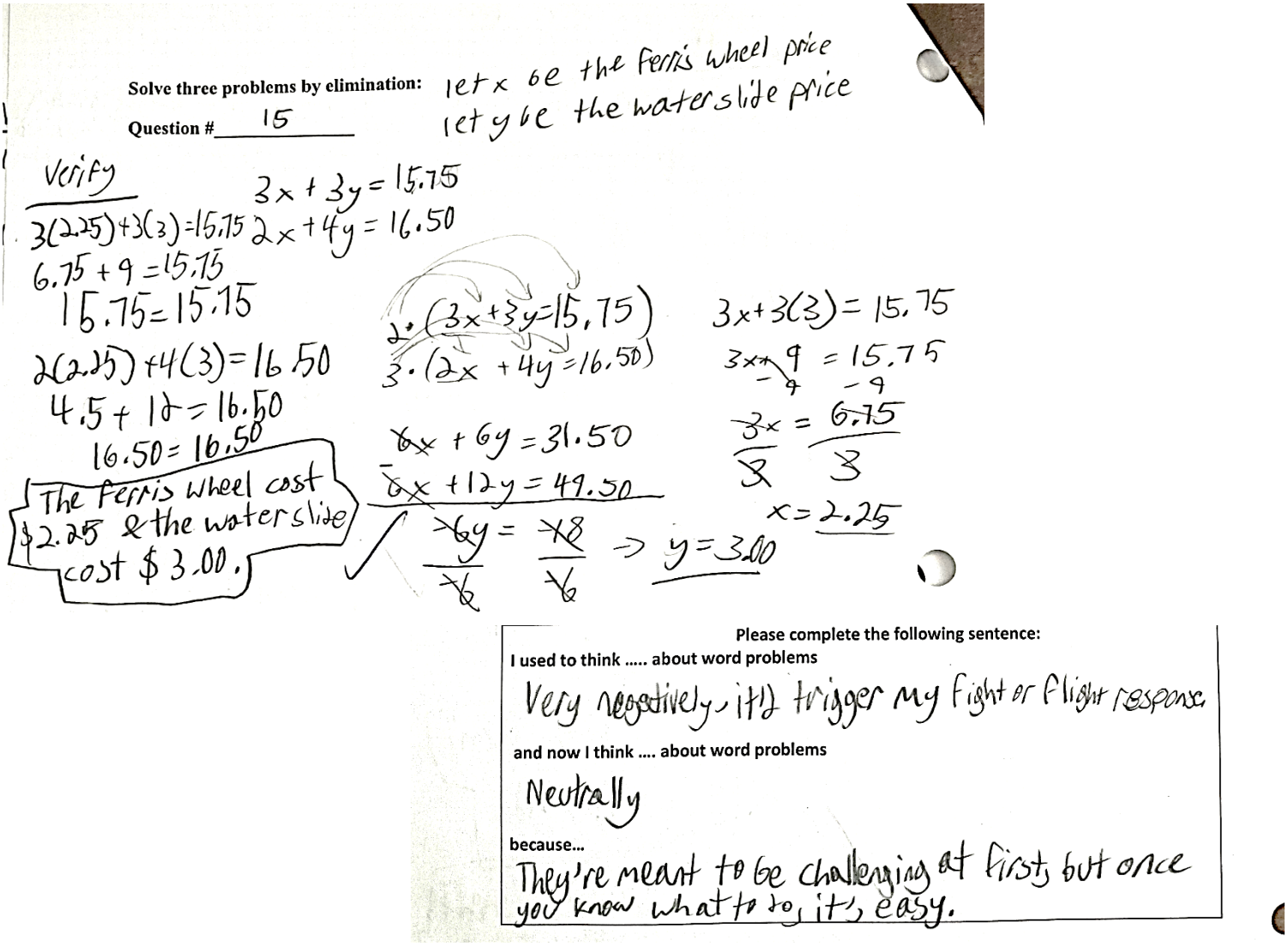
I really, really don't like word problems. I really hate them. They make no sense to me. I hate word problems. I can't understand word problems because I'm quite bad at reading. #hatewordproblemsclub.

Post Activity Reflection: In a short paragraph of two to four sentences, describe your perspective of word problems now.

By first figuring out the x and y (what they are), reading and formating an equation became a bit simpler. I still don't enjoy or like word problems, but I believe I have a slightly greater understanding of them. I hope to get better at word problems in the future.

Students' Reflections

Before this unit, students felt anxiety, confusion and disengagement around word problems. Providing a logical, organized method to comprehend, interpret and extract information from the text of word problems, based on the Cross-Curricular Literacy Learning Progressions, helped students make sense of the problems and feel more confident in their ability to work through them in the future.



Solve three problems by elimination:

Question # 15

let x be the Ferris wheel price
let y be the waterslide price

Verify

$3(2.25)+3(3)=15.75$
$6.75+9=15.75$
$15.75=15.75$

$2(2.25)+4(3)=16.50$
$4.5+12=16.50$
$16.50=16.50$

The Ferris wheel cost $2.25 & the waterslide cost $3.00.

$3x+3y=15.75$
$2x+4y=16.50$

$2\cdot(3x+3y=15.75)$
$3\cdot(2x+4y=16.50)$

$6x+6y=31.50$
$-(6x+12y=49.50)$
$-6y=-18$
$\frac{-6y}{-6}=\frac{-18}{-6} \Rightarrow y=3.00$

$3x+3(3)=15.75$
$3x+9=15.75$
$-9 \quad -9$
$\frac{3x}{3}=\frac{6.75}{3}$
$x=2.25$

Please complete the following sentence:

I used to think ..... about word problems

Very negatively, it'd trigger my fight or flight response.

and now I think .... about word problems

Neutrally

because...

They're meant to be challenging at first, but once you know what to do, it's easy.

Teacher's Observations and Assessment

Observations: In the beginning of the unit, this student really struggled with understanding word problems and identifying what the question is asking. They were frustrated with how tricky it was to interpret the question, let alone identify the unknowns and come up with a system of linear equations. As we worked through the Literacy strategies, slowing down and breaking down the word problems, the student began to actively participate in class discussions. They helped other students with their misunderstandings and collaborated to interpret problems (Use mistakes as opportunities to advance learning). When it was time for the linear equations in-class assessment, the student completed the entire assignment independently without additional support (Solve problems with persistence and a positive disposition). They reflected on their success and the steps they took to achieve it (Reflect on mathematical thinking).

Assessment: The student was able to identify the two unknowns in each word problem by using the information in each question (Model with mathematics in situational contexts). They demonstrated the proficient use of a variety of strategies throughout the in-class assessment (Apply flexible and strategic approaches to solve problems). They were also able to analyze the information in each question to set up systems of linear equations. Once each solution was calculated, they demonstrated that they could verify their answers, justifying the accuracy of the solution. Finally, the student was able to connect the numerical solution to the context in each question.