Journal problem 3: Ordering positive and negative numbers

Introduction:
Be aware that students may take a significant amount of time just to work out where each negative number is on their number line. The aim is for students to figure out how negative numbers work by relating these to credit cards (owing money). They need to determine how to add and subtract negative numbers (relating these to spending and depositing).

You will need: string and measuring instruments for this activity. You will need a card that you can flip over with a black $ sign on one side and a red $ sign on the other side.

Getting Started:
Ask students to find $20 on their number line. Ask students if this is money that you have or owe (you have it). Place the card on the line with the black $ sign facing upwards. Ask students what happens if you spend $10. They should move the $ sign back towards the $10 mark because that is what you would have left. Ask students what would happen if you now were given $50. They should move the $ sign up to the $60 mark because that is what you would have after the deposit. Then read out the first question (start with $20, spend $20). Ask students to replace the $ sign at the $20 and work out what to do with it when you spend $20. Move onto the rest of the questions when you are sure that they know which direction to move the $ sign in when they spend money (towards the negative end) and when they deposit money (towards the positive end).

Leading questions:
- Where do you think the zero would go? How about the 100? Where is the $20 that I have? Where would I put $20 that I owe? Let's flip the card over to be "in the red" when we owe money. Which number is the point where we flip the card?
- So if we have a balance of $20 in a bank account and then we use a credit card to spend $30, what does that mean? Do we owe money to the bank? How much?
- What would it look like if we started off owing money? How about if we owed $20? Now what would happen if we spent more money? Would we owe more or less to the bank? Show me using the number line.

Misconceptions to watch out for:
- Students who try to move in the wrong direction (e.g. if we owe $20 then spend $20 they say that we owe nothing because they do 20-20=0).
- Students who do not realise that each $10 is the same distance apart.
- Students who think that decimal numbers are less than zero so try to give you decimal numbers as answers. Decimal numbers describe parts of wholes, not amounts less than wholes (e.g. 0.5 is between 0 and 1 - it is not 5 less than 0).

Teaching Tips:
Support students: use play money or stick with positive balances.

Follow up ideas:
Relate adding and subtracting negative numbers to shopping trips and bank balances or to temperatures (e.g. it got down to -10 degrees at Thredbo overnight. If the temperature dropped another 5^{o} what would it be?). Also complete Blasts activities A15 and A16.

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Problem 3: Ordering positive and negative integers

Stretch a piece of string across your classroom. Label one end of the string -$100 and the other end +$100. Use this to work out the following problems. Explain how you do each one, and what you learn about adding and subtracting with negative numbers.

Situations to model: Write the equation and the answer.

1. Starting with a bank balance of +$20, I spend $20. What is my bank balance now?
2. Starting with a bank balance of +$20, I spend $30. What is my bank balance now?
3. Starting with a bank balance of +$20, I spend $50. What is my bank balance now?
4. Starting with a bank balance of -$20, I spend $20. What is my bank balance now?
5. Starting with a bank balance of -$20, I spend $50. What is my bank balance now?
6. Starting with a bank balance of +$20, I deposit $20. What is my bank balance now?
7. Starting with a bank balance of -$20, I deposit $20. What is my bank balance now?
8. Starting with a bank balance of -$20, I deposit $30. What is my bank balance now?

Communicating:
Explain how you worked out the answers.

Understanding:
What patterns did you find when adding and subtracting negative numbers?

Teacher initials:

Date:

Problem solving / T&R:
- o Problem solved with minimal or non-mathematical prompting
- o Some leading questions were used to prompt thinking
- o Solved after explanation
- o Did not work out solution
- o N/A- not a novel problem

Reasoning / Comm.:
(verbal, written, working and equations, or visual representations)
- o Clearly and logically reasoned
- o Easily understood
- o Understood with some interpretation needed
- o Some gaps but on topic
- o Minimal or off topic

Understanding / Reflect:
- o Connected manipulation problems to previous questions and answered easily
- o Connected manipulation problems to previous questions with some prompting, and answered correctly
- o Answered once the similarities to previous questions had been pointed out
- o Had some problems in answers but was on the right track
- o Did not answer appropriately

- o Student not observed

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