

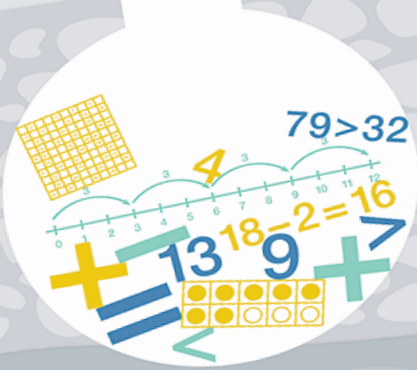
MINE THE GAP

FOR MATHEMATICAL UNDERSTANDING

Common Holes and Misconceptions
and What To Do About Them



John SanGiovanni



CM CORWIN
MATHEMATICS

GRADES K-2

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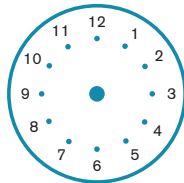
CORWIN

BIG IDEA 34

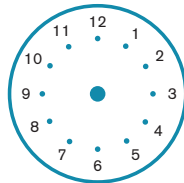
Telling Time and Elapsed Time

TASK 34A

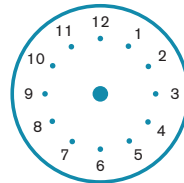
Draw hands on the clock to show the time written below it. Then show each time on the number line



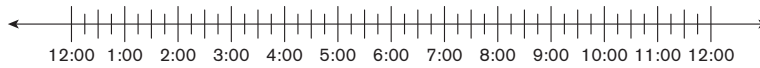
3:30



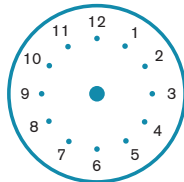
1:15

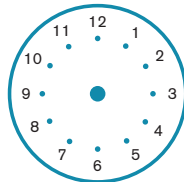


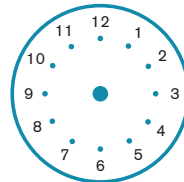
7:45

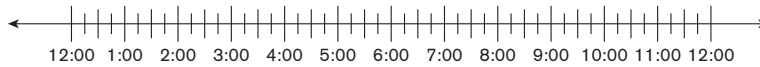


Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.









PAUSE AND REFLECT

- How does this task compare to tasks I've used?
- What might my students do in this task?



Visit this book's companion website at resources.corwin.com/minthegap/K-2 for complete, downloadable versions of all tasks.

About the Task

Our students' work with time may be resigned to recognizing and telling the time on a clock. Drawing the time on a clock can be more challenging for students. A number line model is another way to represent time. This model can be more useful for seeing relationships between hours and finding elapsed time. In this task, students represent time on a clock and on a number line. The task helps students connect representations so that they can apply their understanding and the representations to elapsed time problems in the future.

Anticipating Student Responses

Students may show classic misconceptions about time. They may confuse the hour hand and the minute hand. They may misjudge placement of the hour hand relative to the amount of minutes past the hour. The number line is ticked by 15-minute intervals. This should help with accuracy of placement. Students do not have to label the times on the number lines as none of the times shown on the clocks are remotely close to one another. The times are not in sequential order above the number line. This may provide a challenge to students as they may have to locate each time independently always beginning with 12 o'clock or the top of an hour.

NOTES

WHAT THEY DID

Student 1

Student 1 shows difficulty with representing time on clocks and number lines. Her work with half-past situations show an hour hand pointing at the hour rather than between the hours. The same is true for quarter-past situations, although this misrepresentation is acceptable. Her representations on the number lines are completely incorrect.

Student 2

Student 2's analog representations of time are completely accurate. She even understands time to a 5-minute interval (4:25). In the first prompt, we may think she also has some understanding of time on number lines. This may be true. However, if we look more closely on the second prompt, we see that only one representation is correct and it is with the top of the hour, which is less complicated to show on the number line.

USING EVIDENCE

What Would We Want to Ask These Students? What Might We Do Next?

Student 1

Student 1's errors with analog clocks are not egregious. In fact, we can point out the error and work the idea into varied practice to help her understand. The error does show that she may not fully understand the concepts of time and clocks. We must confirm this before working to develop this understanding on the number line. As we introduce the number line, we should work number lines partitioned by hours. As that proficiency grows, we can transition to half and quarter hours. In later grades, students can use open or empty number lines to model elapsed time.

Student 2

We can celebrate that Student 2 shows good understanding of time on an analog clock. She is poised to connect that understanding to a number line representation. Similar to Student 1, we can sequence the introduction of time to build understanding. To do this, we can progress from o'clock to 30 past, to 15 and 45 minutes past the hour. Student 2 is likely to ask about other time intervals because of her understanding of time to the 5-minute interval. In this situation, we should have conversations about estimating or showing that time between two of the ticked 15-minute intervals.

TASK 34A: Draw hands on the clock to show the time written below it. Then show each time on the number line. Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.

Student Work 1

Draw hands on the clock to show the time written below it. Then show each time on the number line.

3:30 1:15 7:45

Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.

2:15 9:30 6:30

Student Work 2

Draw hands on the clock to show the time written below it. Then show each time on the number line.

3:30 1:15 7:45

Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.

4:25 2:00 7:00

WHAT THEY DID

Student 3

Unlike Student 1, Student 3 shows a better understanding of analog time. The hour hands are adjusted to show minutes past an hour. We can see that she is able to find time past the hour on a number line by first finding the hour and then showing the additional time. Her created times show understanding of different intervals similar to Student 2. She attempts to apply her strategy of finding an hour and counting on but is unsuccessful in translating the 15-minute interval tick marks.

Student 4

Student 4 misrepresents the hour hand in each half-past situation similar to Student 1. However, Student 4's work as a whole shows a more complex understanding of time. She correctly identifies the time locations on the number line. Most interestingly, she accurately places a 5-minute interval (11:55) between 11:45 and 12:00 on the number line.

USING EVIDENCE

What Would We Want to Ask These Students? What Might We Do Next?

Student 3

Student 3 shows many good ideas that we can build on. She shows understanding of time on an analog clock. She indicates that she sees time as an hour and "some more." Her strategy for finding times on a number line can be extended to elapsed time in the future. We need to work with her to develop understanding of the intervals on the number line. She is clearly successful when the provided time is to a quarter hour. But this success falls apart in other situations. We can parallel our work to the sequence described with other students. Student 3 will likely progress through that sequence quite quickly. We can support her accuracy and that of others by labeling the tick marks by the quarter hour. We may need to create a large number line that only shows 2 or 3 hours in total and that has been partitioned and labeled by 15-minute intervals. We can begin to remove the labels as she shows proficiency with placements. We can then begin to introduce other intervals and have discussions about where those times may be placed.

Student 4

Like Student 1, we want to work with Student 4 so she can be precise when representing time on an analog clock. Unlike Student 1, her other ideas demonstrate understanding of time as an hour and minutes past an hour. Her placement of 11:55 is most impressive. It would be interesting to hear the conversations Student 3 and Student 4 might have if they were partnered and tasked with placing times of 5-minute intervals on these number lines.

TASK 34A: Draw hands on the clock to show the time written below it. Then show each time on the number line. Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.

Student Work 3

Draw hands on the clock to show the time written below it. Then show each time on the number line

3:30 1:15 7:45

Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.

9:05 5:40 9:35

Student Work 4

Draw hands on the clock to show the time written below it. Then show each time on the number line

3:30 1:15 7:45

Create a time and write it below the clock and show it on the clock. Then show each time on the number line below.

6:15 3:30 11:55

OTHER TASKS

- What will count as evidence of understanding?
- What misconceptions might you find?
- What will you do or how will you respond?



Visit this book's companion website at resources.corwin.com/minethegap/K-2 for complete, downloadable versions of all tasks.



MODIFYING THE TASK

We can create new cards with time intervals aligned to the values we have been teaching. For example, we can use intervals to the 10-minute, 5-minute, or 1-minute mark.



MINING TIP

Showing movement of the hour hand demonstrates understanding that times within the hour are different and that as minutes pass, we are closer to the next hour.

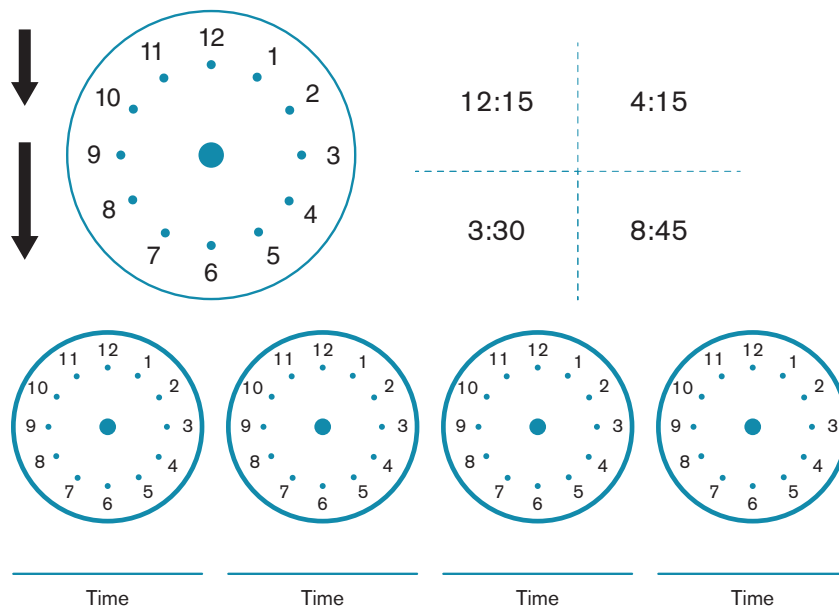


MINING TIP

Some students may be ready to discuss how each quarter hour affects the location of the hour hand.

TASK 34B: Use the clock and hands template and recording sheet from resources.corwin.com/minethegap/K-2.

Cut up the clock and attach the hands to it with a paper brad. Cut up the cards. Turn the cards face down and have students turn them over and make the time shown on the card. Students can write the time from their card on their recording sheet.



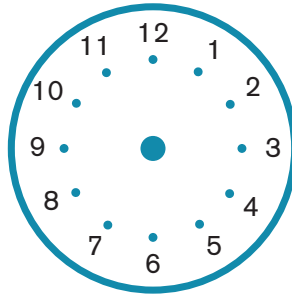
This hands-on task requires *students to make or show the time indicated on a card*. The optional recording sheet helps us capture a written record of their performance. As with Task 34A, students may show misconceptions about the hour and minute hands or how their position changes as minutes past the hour change. It is important that students recognize that the hour hand is halfway between hours at 30 minutes past the hour. Precision may be lost as other times are shown. *Essentially, less than 30-minute past situations could be shown with the hour hand pointing at the hour, and more than 30-minute past situations can be shown with the hour hand pointing between hours. We should be careful to avoid overemphasizing hour hand placements for odd times.*

TASK 34C: Read the clues. Draw the time on the clock.

I am between 2:00 and 3:00.

I am before 2:30.

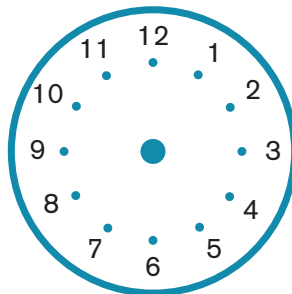
I am sometimes called quarter after 2.



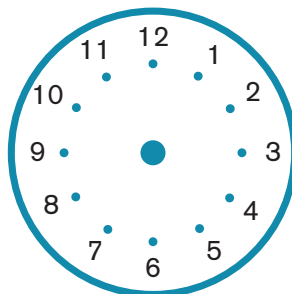
I am between 12 and 1.

I end in "30."

I am half past 12.



Write clues for a time. Show the time on the clock.



Riddles require students to think critically about situations. In this task, students are provided with riddles to represent a specific time on a clock. As students work with the task, we should look for understanding of the clues. Do they understand "between 2:00 and 3:00"? Do they recognize or use common language such as "quarter past"? Do students connect numbers such as "30" with locations on the clock? Students are then asked to write a riddle of their own. We can have their riddles transferred to index cards and used for a center or independent activity.

TASK 34D: Use the time and clock cards from resources.corwin.com/minethegap/K-2.

Spread the cards face down and have students match the clocks with time cards similar to a traditional matching or memory game. You can also use blank time cards to create times with different intervals (5 minute, 10 minute, etc).

The image displays four time cards arranged in a 2x2 grid. Each card consists of a written time and a corresponding clock face. The top-left card shows 2:15 with a clock where the hour hand is between 2 and 3, and the minute hand is at 3. The top-right card shows 7:15 with a clock where the hour hand is between 7 and 8, and the minute hand is at 3. The bottom-left card shows 5:30 with a clock where the hour hand is between 5 and 6, and the minute hand is at 6. The bottom-right card shows 11:45 with a clock where the hour hand is between 11 and 12, and the minute hand is at 9. Below the grid are four number lines, each with an arrow pointing to a specific time: 2:00, 7:00, 5:00, and 11:00.

This task is another way to make use of a classic matching game. Students match clocks with written times and/or times on number lines. We should look for how students find the time on a clock as they attempt to make a match. Do our students always need to find the time on the clock to consider if it is a match? These students are still working to recognize patterns on the clock or generalize representations on the clock. Conversely, other students will discount the possibilities quickly. For example, these students quickly realize they don't have a match when 10:00 (written) is selected and a clock face with a minute hand points at anything other than 12. These students apply similar thinking to other situations as well. Blank cards are provided as templates for creating additional time cards.