

Measuring Time : Instructional Suggestions for Elementary School

Classroom life offers many opportunities to study the concept of time. These include the schedule for a cycle; the number of minutes allotted to each subject during the day, the cycle or the term; the number of days preceding an event that students are eagerly anticipating or how to read a calendar. Other subjects, such as geography, history and citizenship education or ethics and religious culture, also provide an opportunity to talk about time. These subjects often involve the concepts of year and time elapsed between two or more events. In a classroom context, time-related concepts are examined in connection with students' daily activities or events that are meaningful to them. Using daily events is therefore a good way of getting students to take an active interest in what they are learning. For example, you could use a television broadcast or movie schedule to ask students questions about time durations. A time line is another tool that helps students develop their conception of time.

It is very important to distinguish between the two aspects of time: the cardinal aspect, which is related

to the interval between two points in time (e.g. the time elapsed from the moment you arrive at school to the moment you get home), and the ordinal aspect, which refers to a specific point in time (e.g. "it is 5:00 a.m.").

In the initial years of elementary school, storybooks can be used to explore the notion of time and ask students questions about their conception of time. For instance, students can be led to discover that units of time can be very small (seconds) or very large (years). These units are fixed; they do not change according to the context, even if students may find that some minutes seem longer than others. It would be useful to ask them why this is so. This is where affective factors come into play. For example, many students may find that a physical education class seems shorter than a mathematics class even though both last the same amount of time. This and the fact that it is easier and more efficient to use standard units to communicate with others is why it is important to teach standard units of measure.



Tools for measuring time . . .

The tools most often used to tell time are analog or digital watches and clocks.

Analog clock:



Digital clock:

3:29

A datebook and calendar can also be used to situate oneself in time.



Lastly, time durations can be measured using an hourglass (qualitative) or a stopwatch (quantitative).



Cardinal aspect

- To measure time durations, young children use informal units, such as the number of sleeps, or they draw a comparison with an event whose duration they know (e.g. a television program). In order to be able to communicate with others more precisely, they must use more conventional units like seconds, minutes, hours, days, weeks, months, years, decades, centuries and millenniums.
- Before using standard units, students could compare the duration of two events, one of which is included in the other. The teacher could ask students to explain how they determine whether a music class lasts a longer or shorter amount of time and could then have them replace their affective (more personal) points of reference with conventional ones like a half day of classes. The next step would be to compare the duration of two distinct events.
- When students want to get to a certain place, they realize that their travel time depends on how fast they walk: the faster they walk, the less time is required to get to their destination. Thus, “children will conceive of time duration as the inverse of speed and conclude that the fastest takes the least amount of time. In this case, time is understood in terms of a comparison of speeds.”¹
- Students must know how many seconds there are in a minute, how many minutes there are in an hour, how many hours there are in a day and how many days there are in a month.

¹ (DeBlois 2011) [translation].

- Determining a time duration involves knowing how many minutes are left before we reach the next hour (use multiples of 5 minutes to facilitate calculations). To make this easier to understand, the teacher could have a discussion with students by asking them the following types of questions:
 - What time is it now and in how many minutes will we reach the next hour of the day? (The teacher could ask this question several times a day.)
 - How many minutes went by between the time they woke up and the time they left for school?
 - What is the duration of the different class periods in their schedule (subtraction of time)?
 - What is the total amount of time devoted to the different subjects in a cycle (addition of time)?
- It should be pointed out to students that when they add or subtract time durations, they are no longer working with a base 10 system, as is the case with integers and decimals, but with a base 60 system. For example, $1 \text{ h } 55 \text{ min} + 2 \text{ h } 10 \text{ min}$ does not equal $3 \text{ h } 65 \text{ min}$.²
- When adding up time durations, always keep in mind possible and necessary conversions (1 hour = 60 minutes; 1 minute = 60 seconds). For example, to add 2 h 15 min and 4 h 55 min, we can add the hours together and the minutes together to obtain 6 h 70 minutes. However, we must remember that 70 minutes is equivalent to 1 h 10 min, so we must add 1 h 10 min to 6 h, which gives a result of 7 h 10 min.
- Determining the amount of time elapsed between two specific points in time involves subtraction. For example, calculate the duration of a movie that starts at 3:55 p.m. and ends at 5:15 p.m.

$$\begin{array}{r} 5:15 \\ - 3:55 \\ \hline ? \end{array}$$

Since 15 is less than 55, remember to convert one hour into 60 minutes when performing the operation $15 - 55$.
5:15 will then become 4:75.

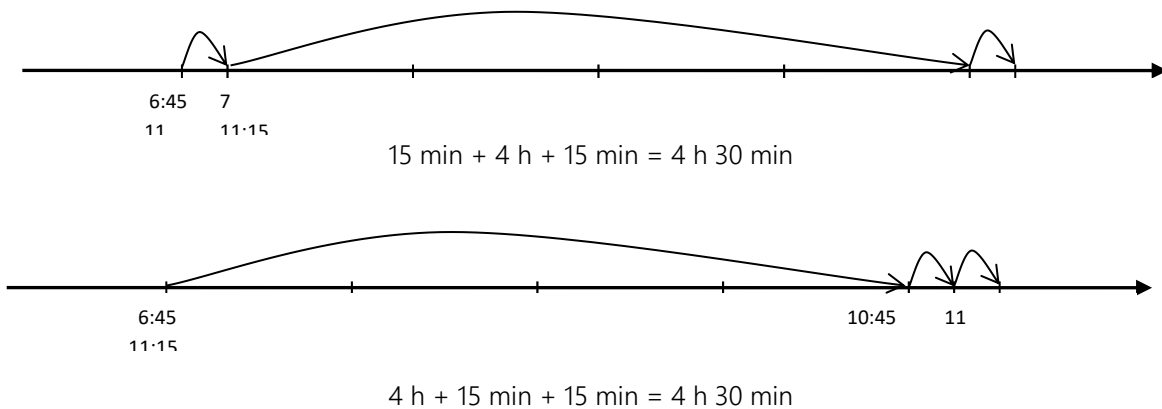
$$\begin{array}{r} 4:75 \\ - 3:55 \\ \hline 1:20 \end{array}$$

← The answer is 1 h 20 min.

² Some students may have already noticed that, in different sports, times are measured in tenths and hundredths of a second. Discussing this with them will make it possible to clarify the situation and answer their questions.



- A simple time line can be used to add and subtract elapsed time. Note that there are different ways of illustrating a problem. For example, the time elapsed between 6:45 a.m. and 11:15 a.m. could be illustrated as follows:



Ordinal aspect

- Before telling time, students should be able to arrange events in order, knowing what comes before or after.
- Understanding the time indicated on an analog clock could help students get a sense of how to tell time on a digital clock. Reading time on a digital clock may seem easier, but it can be more difficult to interpret what the numbers are telling us. "To know that a digital reading of 7:58 is nearly 8 o'clock, the child must know that there are 60 minutes in an hour, that 58 is close to 60, and that 2 minutes is not a very long time."³
- To learn how to tell time on an analog clock, it is easier to begin with a clock that has only the little hand. Students will therefore have to give an approximate time ("It's about 3 o'clock" or "It's a little past 6 o'clock" or "It's halfway between 1 o'clock and 2 o'clock"). Then, discuss what happens to the position of the minute hand as the hour hand goes from one hour to the next. To teach students how to tell the exact time on a real clock more quickly, have them count by fives until they get to the nearest 5-minute interval. From there, they can determine the exact position of the big hand to tell the time to the nearest minute.

³ John A. Van de Walle and LouAnn H. Lovin, *Teaching Student-Centred Mathematics, Volume One* (Toronto: Pearson Education Canada, 2007), 243.

- Students will find it easier to tell time on an analog clock if they recognize that:
 - the hands turn rightward from the top
 - each minute is represented by a small line on the edge of the clock and there are bigger lines at each 5-minute interval
 - the small hand points toward a number that represents the number of hours
 - the big hand points toward the line that represents the number of minutes
 - the third hand indicate the seconds
- Students will find it easier to tell time on a digital clock if they recognize that:



3:52

- the number to the left of the colon indicates the hour and the number to the right indicates the minutes
- the time is indicated according to the 12-hour clock or the 24-hour clock

Web links regarding time

- *Teaching Student-Centred Mathematics, Volume One: Grades K-3, pp.242-245*
http://www.fmpsd.ab.ca/TSCM_K-3/Math_K-3.html
- *Teaching Student-Centred Mathematics, Volume Two: Grades 3-5, pp.269-271*
http://www.fmpsd.ab.ca/TSCM_K-3/Math_K-3.html
- <http://tipirate.net/educatif/184-apprendre-a-lire-l-heure>
- <http://www.informatique-enseignant.com/ressources-pour-apprendre-heure>
- www.sanslivre.com
- www.mathematiquesfaciles.com, click on "Cours et exercices," then "Cours" and choose "Heures et durées (3) addition..." or "Heures et durées (4) soustraction..."



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