

Case study 1:

Mathematics – Norway

School	Møhlenpris oppveksttun, Primary school, Bergen, Norway
Teacher	Margrethe Skogland
Grade	Grade 6
Pupils	24 pupils, aged 11 – 12 years, the majority of them had a Norwegian background and a few had an immigrant background. Some of the pupils with an immigrant background received additional help/support in basic Norwegian in order to support their subject learning and had lessons strengthening their knowledge of their L1.
Subject and topic	Mathematics
Number of lessons	22 lessons (each 45 minutes)

Main teaching and learning goals

Subject goals:

- To expand fractions to get a common denominator
- To understand the connection between fractions and decimal numbers
- To add and subtract fractions with common and different denominators
- To multiply fractions

Language goals:

- To read fractions aloud
- To explain orally to another pupil or the teacher how to expand fractions
- To explain how to go from fractions to decimal numbers, or vice versa
- To describe in writing (write a log) how to add/subtract fractions with different denominators.

Progression of topics

- Equal fractions
- Fractions and decimal numbers
- Addition and subtraction of fractions
- Fractions with different denominators
- A fraction of something
- Repeated addition
- Text based tasks

Teaching methods and activities

Introduction

The teacher started by trying to activate the pupils' prior knowledge by asking them to fill in a form containing words related to fractions like equal fractions, numerator, denominator, improper fractions, decimal numbers etc.. At the end of the teaching period, the pupil was given the form to note down what they then knew about the meaning of the words.

Modelling how to solve tasks:

The teacher and the pupils solved a number of tasks together – starting with the teacher working on the blackboard/smartboard and the pupils in their books. After initial examples, individual pupils solved tasks in front of the other pupils. Based on the examples, pupils formulated rules for the mathematical operations, at first individually, and then in pairs and finally all together.

Working with tasks in the textbook, including web-based tasks

The teaching materials included a textbook but also a web based programme where the difficulty of the tasks adapts according to the ability of the individual pupils. While the pupils worked, the teacher was able to go around and see how the pupils work how difficult the tasks were they worked with. The pupils also worked with web-based tasks at home.

Guided mathematics

In some lessons, the work was organised in 'stations'. Small groups went from station to station where they carried out specific tasks. The teacher could then talk to each group (or individual pupils) about how to solve different tasks.

Logs

All pupils wrote logs during the teaching period where they explained/described procedures they used when working with fractions.

Filming

In the middle of the teaching period, four pupils were filmed while explaining how to add/subtract fractions.

Self-assessment

The pupils assessed to what extent they had reached the learning goals during period focusing on fractions. The teacher reported that the pupils seemed to have a realistic opinion of their own knowledge and abilities.

See the self-assessment form at the end of this document

19 (out of 22) pupils answered 78% or more tasks correctly.

The teacher reported that the results were better than she expected. She also reported that she saw a positive correlation between how much the pupils worked on the web-based tasks at home and the test result.

Comments

Some of the pupils with immigrant background had problems reading fractions aloud, more specifically; they had problems with ordinal numbers. Instead of reading $\frac{3}{5}$ as two-fifths, they said two of five.

The pupils (both Norwegian pupils and pupils with an immigrant background) had problems explaining or describing what they did when expanding fractions. Some examples:

Pupil 1

"In order to expand a fraction you have to multiply the fraction with the lowest denominator so that both turn out the same, for instance:

$$\frac{4}{5} + \frac{1}{10} = \frac{4 \times 2}{5 \times 2} + \frac{1}{10} = \frac{8}{10} + \frac{1}{10} = \frac{9}{10} "$$

Pupil 2

"You will have to multiply the denominators with each other. Afterwards you must multiply the numerator with the denominator on the other fraction, like this:

$$\frac{5}{8} + \frac{7}{5} = \frac{5 \times 5}{8 \times 5} + \frac{7 \times 8}{5 \times 8} = \frac{25}{40} + \frac{56}{40} = \frac{81}{40} = 2\frac{1}{40} "$$

Both pupils know how to add fractions. When the teacher knows what they are working with, she understands their explanations. Still the explanations are not detailed enough to convey the message to outsiders, or make pupils who do not know what to do, understand.

Pupils with a B1 language proficiency should be able to explain and describe in a straightforward way, according to the Common European Framework of Reference (2001), while at B2, pupils are able to do it in a detailed way. Maybe we are touching on a maturity issue here, i.e. that pupils at the age of 11-12 would typically be at a B1 level in terms of language, even in their L1. On the other hand, one would expect pupils at the age of 15-16 to have reached a B2 level in their L1. According to the teacher, explaining and describing different mathematical operations helped the pupils to build knowledge and understand. At the same time, they were not able to perform this (explain, describe) in a detailed way. This is probably due to their age. This is in line with Nippold (2007), Hasselgreen & Claudwell (2016) and Moe et. al. (2016).

Self-assessment

Pupil:

Grade 6

Subject: Mathematics

Fractions

My aims		I can do this (tick off)			
	I cannot do this yet.	with the help of my teacher or classmates	quite well	very well	I have evidence
Date					
1. I can expand fractions in order to find a common denominator.					
2. I can explain how to expand fractions to find a common denominator.					
3. I can add fractions with different denominators.					
4. I can describe what I do when I add fractions with different denominators.					
5. I can subtract fractions with different denominators.					
6. I can describe what I do when I subtract fractions with different denominators.					
7. I can explain how I write $\frac{5}{100}$ as a decimal number.					