



FaSMEd

Raising Achievement through
Formative Assessment
in Science and Mathematics
Education



Introduction to fractions: a formative assessment sequence for remediation

Subject:	Maths
Age of students:	9 - 10 years
Technology:	Clickers (software “Je lève la main”), teacher PC, projector
Functionalities:	Sending and displaying, processing and analysing
Time:	5 lessons
Short Abstract:	After a cycle of lessons introducing the concept of fraction and the main required competencies, the teacher organizes a formative assessment cycle of five lessons. Using the tool, the teacher gets information about where the learners are and organises remediation groups with activities adapted to each student's needs.



1. Content

This cycle of lessons covers the introduction of the mathematical topic of fractions. The different representations of fractions are studied as well as the comparison of two fractions with the same denominator.

2. Activity

2.1 Aims

The objectives of the lessons in terms of knowledge and competencies to acquire are:

1. identifying fractions with diagrams and charts,
2. reading and writing a fraction,
3. recognizing and finding equivalent fractions and equalities of fractions,
4. placing a fraction on the number line,
5. reading a fraction placed on the number line,
6. comparing two fractions with the same denominator.

2.2 Structure / Methodology

Session 1 aims at evaluating students' competencies through a quiz. It consists of 48 questions: 6 types of exercises dealing with the 6 targeted competencies.

Each exercise is transformed into a multiple choice question where three or four options are proposed. The whole quiz is available as "intro_fractions-quiz1" (in the tek format supported by *Je lève la main*) and one example for each type of multiple choice question is given in "intro_fractions-examples-quiz1". Between session 1 and session 2, the teacher analyses the answers for planning next lessons.

Sessions 2, 3 and 4 consist of remediation workshops and individual work depending on the quiz results. An example of exercise given to students for working on the competence "identifying fractions with diagrams and charts" is the following one.

For each figure write the fraction that represents the coloured part:

Pour chaque surface dont le contour est rouge, indique la fraction de surface qui a été coloriée.



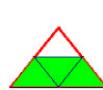
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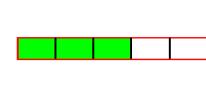
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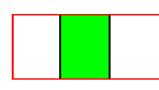
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Remediation activities are differentiated:

- Individual work for some students (medium and high achievers).
- Work in groups with the teacher for low achievers.



Session 5 is devoted to a second quiz similar to the first one.

Medium and high-achievers take the version 1 in paper and pencil (see “intro_fractions-quiz2-paper&pencil”): all the 48 questions are asked as open questions.

Low-achievers, who have worked in group specifically on competence 1, take the version 2 with clickers (see “intro_fractions-quiz2-group1”): the whole group of 10 questions concerning competence 1 (identifying fractions with diagrams and charts), and a specific selection of other 38 questions, depending on the most frequent mistakes done in the first quiz.

Low-achievers, who have worked in group specifically on competencies from 3 to 6, take the version 3 with clickers (see “intro_fractions-quiz2-group2”): a specific selection of questions from the first quiz, according to the most frequent mistakes.

2.3 Technology

Je lève la main is used as a student response system that allows to collect quickly the answers of all the students and to have them organised in tables. The possibility of sending and displaying information is the functionality of technology that supports the teacher in establishing where the learners are in their learning. Moreover, *Je lève la main* stores the results in tables as in Fig. 1., organising them by student and by question. This helps the teacher process and analyse the collected information. This functionality of technology facilitates the teacher’s interpretation of data.

A1	N°	Nom	Score	Résultat des votes enregistrés												
				Réponse correct		1	2	3	4	5	6	7	8	9	10	
	10	Ali	360	36	x3	1	3	2	1	x1	2	1	x1	2		
	11	Ali	440	44	2	1	3	2	1	x1	2	x2	3	2		
	12	Ali	340	34	x1	1		3	x1	1	x1	2	1	x1	2	
	13	Ali	340	34	x1	x2		3	2	1	x1	2	1	x2	2	
	14	Ali	440	44	2	1	3	2	1	x1	2	1	3	2		
	15	Ali	420	42	2	1	3	2	1	3	2	1	3	2		
	16	Ali	440	44	2	1	3	2	1	3	2	x3	3	2		
	17	Ali	350	35	2	1	3	2	1	x1	2	1	3	2		
	18	Ali	430	43	2	1	3	2	1	3	2	1	3	2		
	19	Ali	370	37	2	1	3	2	1	x1	2	x3	x1	x3		
	20	Ali	420	42	2	1	3	2	1	x1	2	1	x2	2		
	21	Ali	320	32	2	1	3	x1	x2	---	2	1	3	2		
	22	Ali	0	0	---	---	---	---	---	---	---	---	---	---	---	
	23	Ali	320	32	2	x2		3	x1	x2	x2	2	1	x1	2	
	24	Ali	420	42	2	1	3	2		x1	2	1	3	2		
	25	Ali	460	46	2	1	3	2	1	---	2	1	3	2		
	26	Ali	370	37	2	1	3	2	1	x2	2	x3	3	2		
	27	Ali	360	36	2	1	3	2	1	3	2	1	3	2		
	28	Ali	480	48	2	1	3	2	1	3	2	1	3	2		
	29	Ali	300	30	2	1	3	2	1	x1	2	1	3	2		
	30	Ali	280	28	x1	x2		3	x3	x3	3	2	x3	x1	2	
	31	Ali	320	32	x1	x2	x2	3	x3	x3	2	1	3	2		
	32	Ali	420	42	2	1	3	2	1	3	2	1	3	2		
	33	Ali	420	42	2	1	3	2	1	3	2	x2	3	2		
	34															
	35	Taux de réponses				78.3	82.6	95.7	78.3	87.0	42.9	100.0	73.9	69.6	95.7	

Fig. 1: Table of the results by question and by student.

2.4 Aspects of Formative Assessment

Establishing where the learners are in their learning and where they are going

Taking the quizzes, the students are activated as the owners of their own learning.

The analysis of students’ answers allows the teacher to engineer situations, tasks, discussions enhancing students’ understanding and to prepare the “progression diagram” for each student (see Fig. 2, and “intro_fractions-students’ skills diagram” for the model). Each student receives his/her diagram at the beginning of session 2.

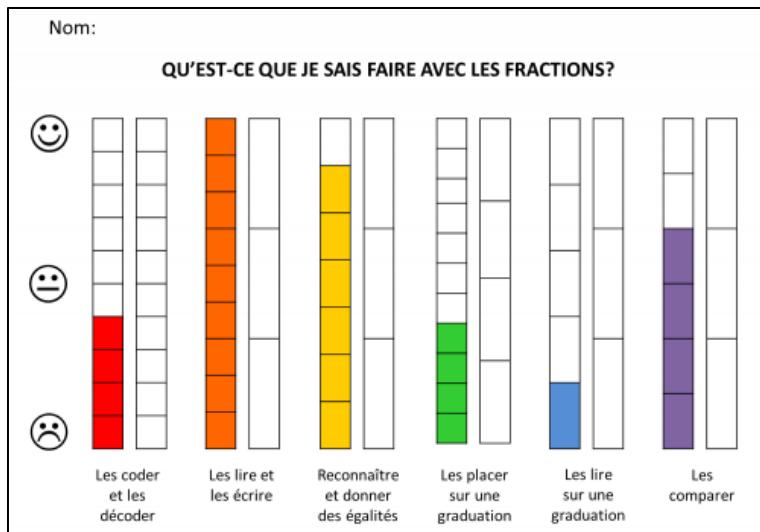


Fig. 2: The progression diagram of a student.

This kind of feedback clarifies the learning objectives and criteria for success, and allows each student to position him/herself with respect to the target competencies, understanding what needs to be revised and improved.

Establishing what needs to be done to get them there.

The teacher provides feedback that moves the learner forward, especially during sessions 2, 3 and 4 through remediation groups, where students are activated as instructional resources for one other. Working in each group, the teacher engineers effective discussions and new learning tasks that elicit evidence of student understanding.

The teacher use feedback to inform and modify her teaching. In particular, remediation sessions (2-3-4) are constructed on students' results that constitute a feedback for the teacher.

3. Further Information

The teacher explains her strategy after having analysed the first quiz:

"What I find interesting is that there are different exercises for each competence [...] Well, yes, yesterday, when I read the results, it was the idea, I tried to, well, relatively to the competencies that we have worked on, I tried to look at students that had difficulties. Therefore, as you said, it's not because they have made one mistake, but from the ten questions, then I established my groups with the number of mistakes [...] I tried to do that, you know, for each competence, I made a sort of percentage of students having the same difficulties."

The students' perceptions or feelings about the lesson can be summarized in this teacher's reflection:

"Yes, writing! It's the first thing they (the pupils) tell me: Ah! Isn't it possible to work always like that? (Laugh) because, they have the feeling that it's quicker than the classical assessment, but in fact, they spent a lot of time!"



4. References

Je lève la main:

<http://www.speechi.net/fr/index.php/home/evaluer/boitier-de-vote-interactif/>

<https://www.jelevamelamain.fr/en/>

For further information (in French):

[https://ife.ens-lyon.fr/fasmed/spip.php?rubrique16.](https://ife.ens-lyon.fr/fasmed/spip.php?rubrique16)