

How can technology support effectively formative assessment practices?

A preliminary study

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Ongoing research within a wider European project



Improving progress for lower achievers in Science and Mathematics through **formative assessment** with the **support of technology**

Definition of **formative assessment**

“Evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited” (Black & Wiliam, 2009)

Hypothesis concerning the **role of technology**

It amplifies the quality of the evidence elicited about students' achievement.

Context of the study



Grade 9 **tablet classroom** (school project): one tablet to each student who is responsible for it during school hours and uses it for all the subjects.

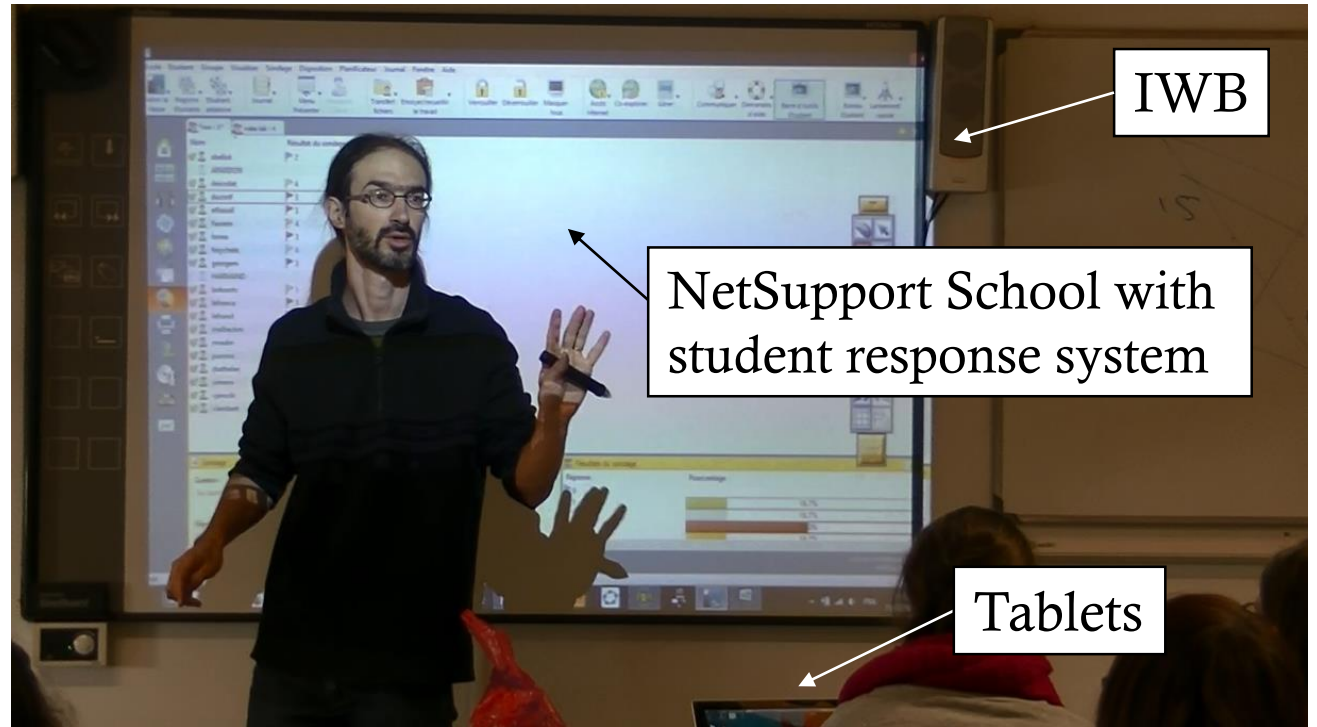
NetSupport School :
used for connecting tablets to teacher's computer/tablet and for communicating with students.

IWB :
can be used for projecting, sharing, commenting students' works.

Focus and questions of the preliminary study

*“In the emerging world of a tablet classroom the **teacher** is likely to be a principal learning designer”*
(Walling, 2014, pp. 26-27)

- Several **technical** competences are needed
- Adaptation, redesign and new possibilities of exploitation of **didactic** activities



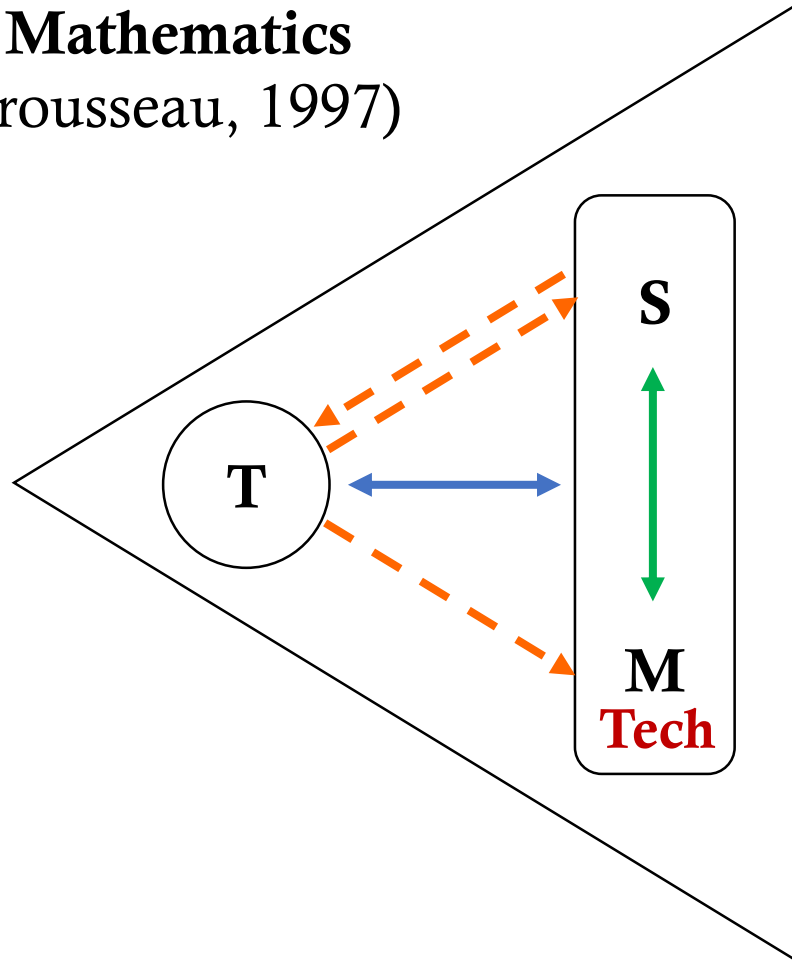
Which **formative assessment practices** involving technology could be efficiently proposed?



How does the teacher

- process data from students using technology?
- use them to inform his teaching?

Theory of Didactic Situation in Mathematics (Brousseau, 1997)

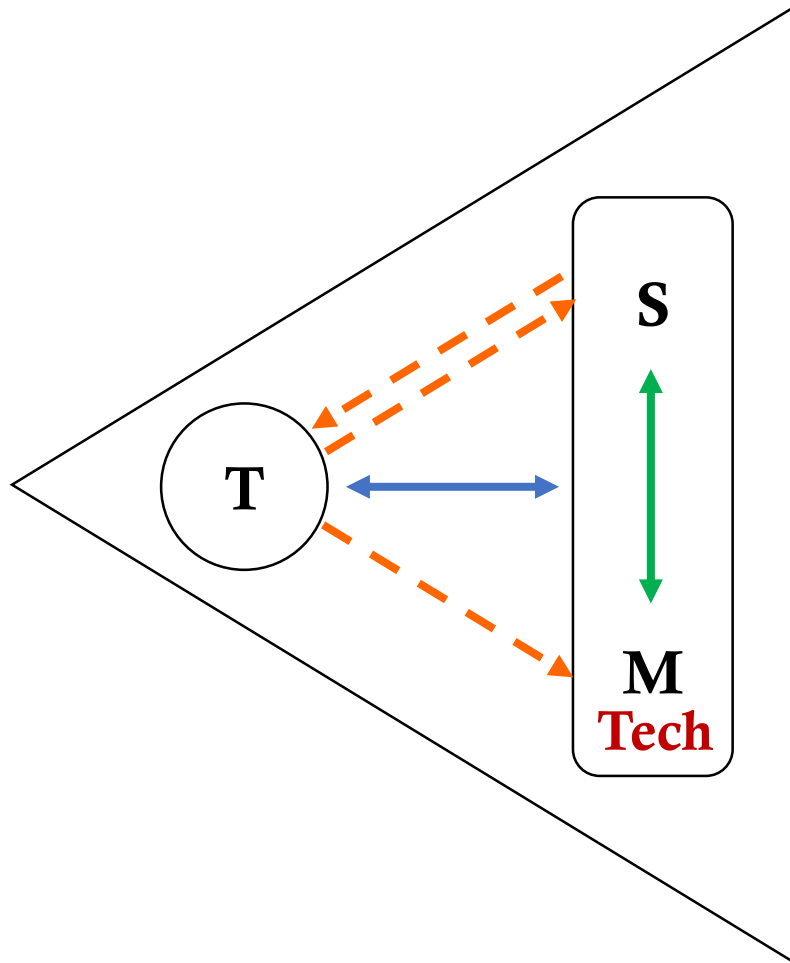


The **teacher creates** a *milieu* for the student and **modifies** it depending on the **student-milieu interaction**.

Technology as part of the *milieu* plays a fundamental role in informing the student.

Instrumental genesis (Rabardel, 1995) as the **teacher appropriates** CCT the **student appropriates** the tablet and its applets, they adapt the digital tools to their needs.

Instrumental orchestration (Trouche, 2004) as the **teacher coordinates** students' individual/collaborative/collective work.



Feedback coming from technology is useful for

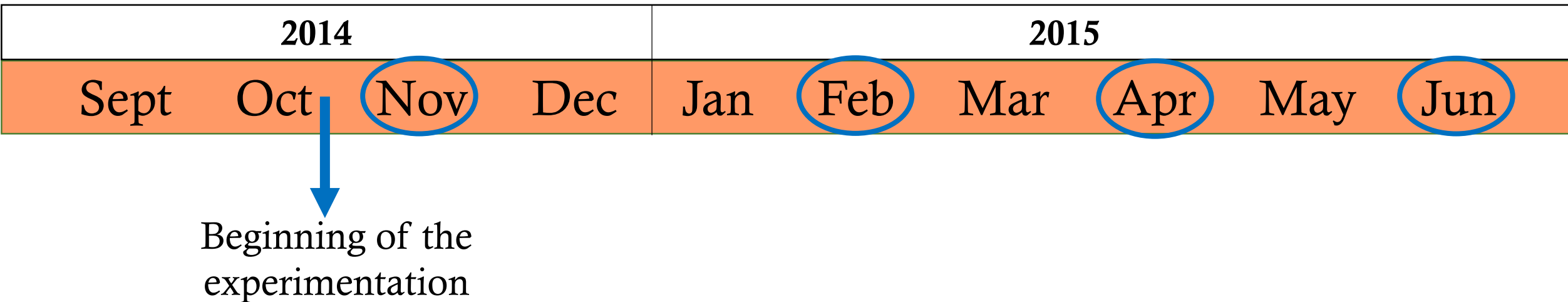
- the student to improve her performance or to change her strategy.
- the teacher to have a class overview, to identify problematic notions and students in difficulty, and to adapt her didactic strategy.



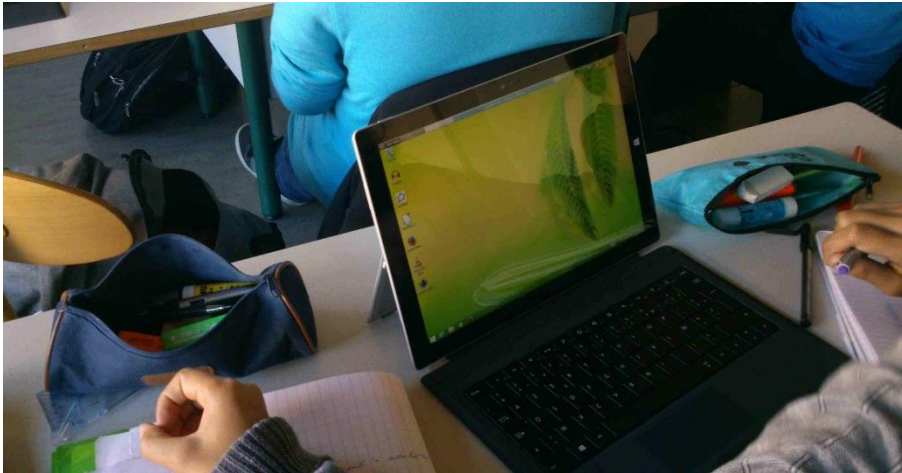
Assessment becomes actually **formative** and can efficiently contribute to the students' learning.

Methodology of observation and data collection

- **Logbook** : document filled in by the tablet classroom's teachers
- **Observation grid** : important points to reflect upon before and after the observation
- **Classroom observations** : videos, photos, audios, teacher's report and notes
- **Discussions and meetings**
- **Interviews** with teacher and students



First observation: November 2014



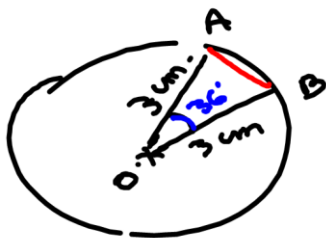
T's orchestration choice:

"You have many possibilities: you can draw the figures by hand in real dimensions, you can do some calculation [...] you can also draw the figure in real dimensions with GeoGebra if you want. Do whatever you want. [...]"

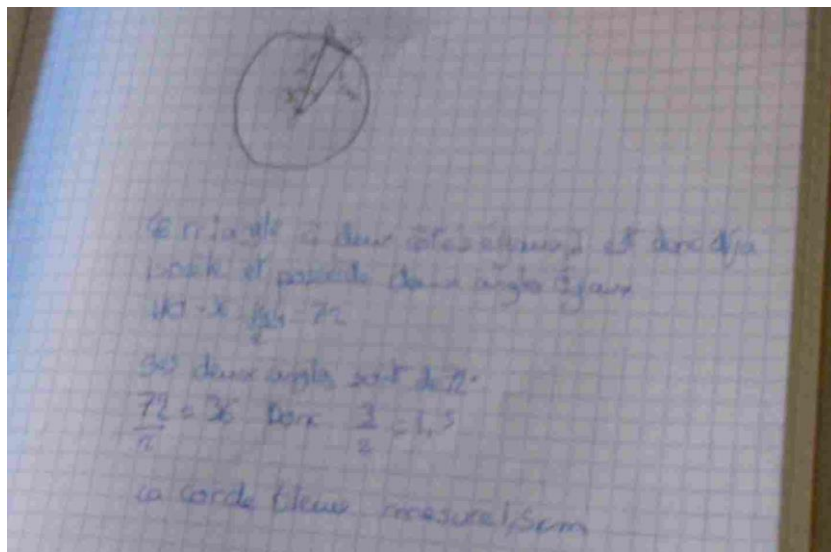


Students use the tablet mainly as a mean of communication to send their answers.

First observation: November 2014



Quelle
est la mesure
de \widehat{AOB} ?



Proposition de Stévan:

Les 2 autres angles des triangles
mesurent 72°

36° c'est moitié de 72°

Donc \widehat{AOB} mesure la moitié de \widehat{B}

il suppose
une proportionnalité
entre les angles et
les longueurs.

T's orchestration choice: comparing students' proposals.

"I'm going to take S1, then you [S2] will tell me the way you concluded".

T copies S1's proposal at the IWB for sharing it with the classroom.

"What mathematical property is he using?"

T's orchestration choice: making a survey.

"I'm going to ask you the question on the tablet, you will answer on the tablet"

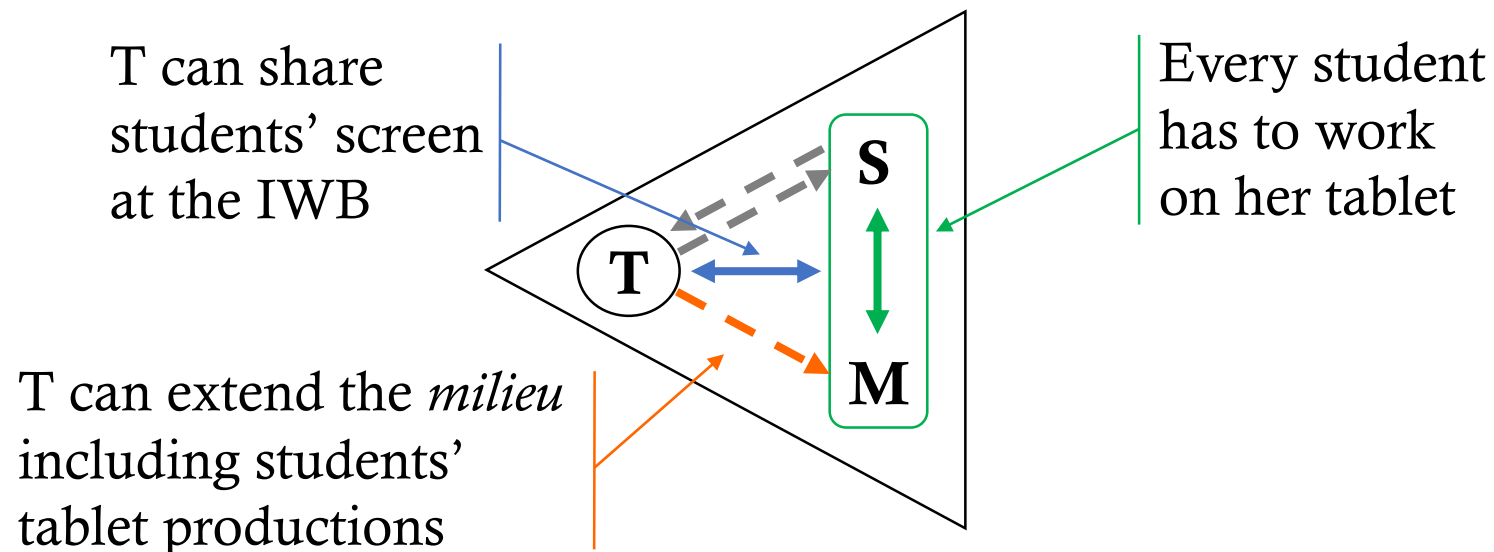
accompanied by an oral survey for interpreting students' answers via tablet.

T's potential techniques to foster formative assessment:

1. Discussion about a student's proposal
2. Survey in the classroom

Evidences about students' achievement are **elicited** and **interpreted**, **but** exploiting them is complicated and time demanding

How using technology to be more effective?

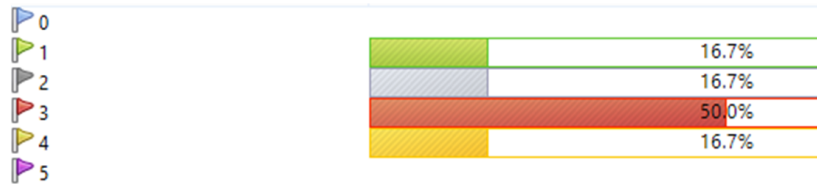


Second observation: February 2015

Jeu: Différence de 2 des à six faces-

On peut parier sur: 0; 1; 2; 3; 4; 5.

Je parie sur:

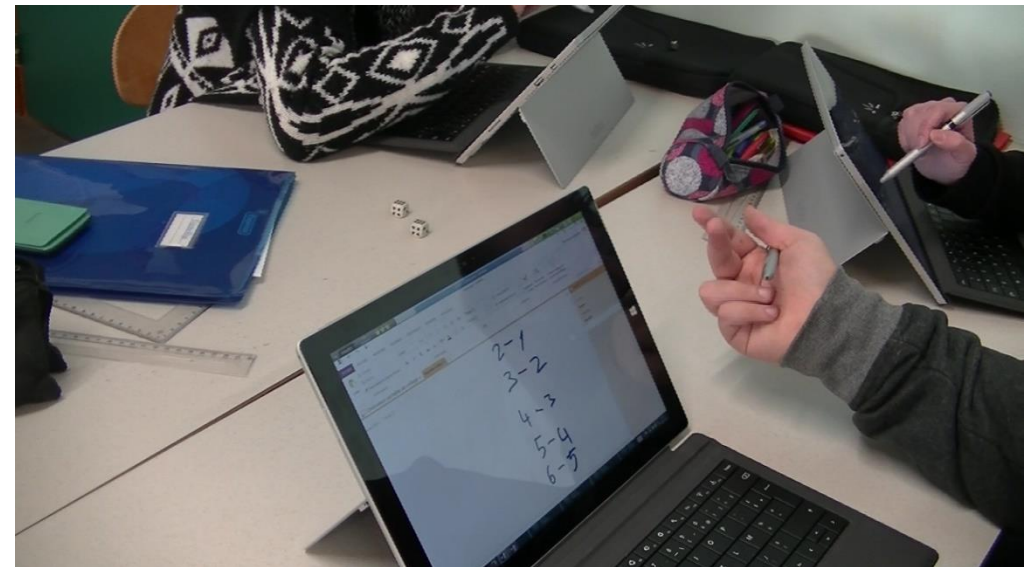


T's orchestration choice:

"Everyone writes what he wants of the group, it has to be the same idea for each group, but everyone on her tablet, on OneNote."

T's orchestration choice:

Making a survey via tablet to collect the initial perceptions of students.



Second observation: February 2015

② Méthode des combinaisons:

Tout es les combinaisons possibles.

Méthodes des combinaisons

6-6=0	5-5=0	4-4=0	3-3=0	2-2=0	1-1=0
6-5=1	5-4=1	4-3=1	3-2=1	2-1=1	
6-4=2	5-3=2	4-2=2	3-1=2		
6-3=3	5-2=3	4-1=3			
6-2=4	5-1=4				
6-1=5					

Il y a 21 combinaisons.

Avec ce modèle en parie sur 0

cela ne correspond pas à la méthode des test: il y a un problème.

Les tirages qui ne sont pas des doubles ont 2 combinaisons possibles.

Il y a 36 combinaison possibles.

6x6

1	2	3	4	5	6	
1	0	1	2	3	4	5
2	1	0	1	2	3	4
3	2	1	0	1	2	3
4	3	2	1	0	1	2
5	4	3	2	1	0	1
6	5	4	3	2	1	0

Le 1 apparaît: $\frac{10}{36}$ fois

Le 0

2

3

4

5

$$\frac{6}{36}$$

$$\frac{8}{36} \approx 0,2222 \dots$$

$$\frac{6}{36}$$

$$\frac{4}{36}$$

$$\frac{2}{36}$$

La probabilité d'apparition du 1 est $\frac{10}{36}$, environ 0,277.

T's orchestration choices:

- collecting one production for each group through tablet screen shots
- showing different proposals at the IWB
- discussing and commenting them with the classroom, while tablets are blocked
- integrating them in the lesson notes



Signs of evolution

In the teacher's
appropriation
of the CCTs: new
orchestration skills

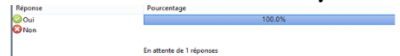


In the teacher's
didactic practices
with CCTs, especially the
formative assessment ones

Reconnaître une fonction affine.

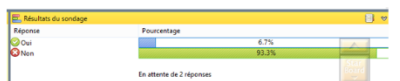
Fonction affine
oui/non

$$f(x) = 3x + 5$$



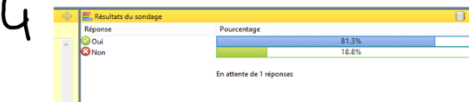
Oui

$$f(x) = 4x + 0$$



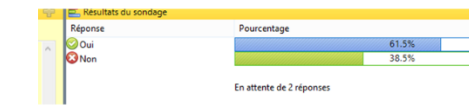
Oui

$$f(x) = 2x^2 + 4$$



Non.

$$f(x) = \frac{x}{3} + 8$$



Oui, car $\frac{x}{3} = \frac{1}{3} \times x$

Use of the survey data (April 2015)

c'est une fonction linéaire \Rightarrow vrai : que et quand $b = 0$.

Quand on varie la valeur de (a) la droite pivote

Quand on varie la valeur de (b) la droite monte et descend

- Nature : fonction affine
- Rôle de a : a est coefficient, a multiplie x
- Rôle de b : b est coefficient, b s'ajoute au résultat

Nature : c'est une courbe rectiligne.

Rôle de a : a sert à donner la direction de la courbe.

Rôle de b : b sert à donner la hauteur de la courbe.

c'est une droite (à prouver)

ordonnées

quand le coefficient a se met sur les ordonnées la fonction se place les ordonnées par contre le coefficient b quand c'est un nombre négatif la fonction se met aussi dans le négatif.

monte quand a > 0

a = 0 négatif descend

Proposals sharing and discussion (April 2015)

How can technology support formative assessment practices?

CCT are integrated in *T*'s didactic techniques to foster formative assessment:

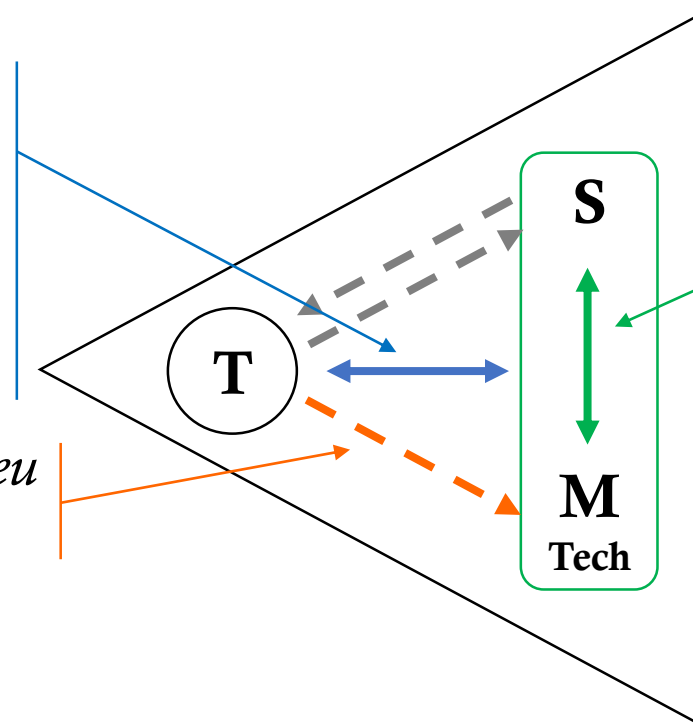
1. Discussion about a student's proposal
2. Survey in the classroom

Technology supports the process of **collection-interpretation-exploitation** of students' achievement evidences

T's orchestration skill of sharing tablet screenshots at the IWB

allows to **compare** and **discuss** students' ideas

in order to **enrich** the *milieu* with students' proposals



T's orchestration choice of making each student work on her own tablet facilitates **collection** and personalised **intervention**

Each student can position herself with respect to classmates' productions and in her learning path

THANK YOU!



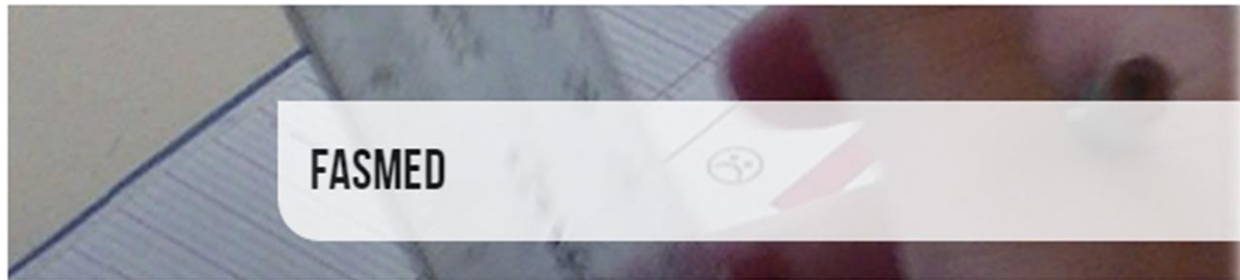
FaSMEd

LE PROJET

EVALUATION FORMATIVE

RESSOURCES POUR LA CLASSE

ELABORER MES RESSOURCES



FASMED 

mercredi 22 avril 2015

Le projet FaSMEd s'appuie sur une collaboration de partenaires internationaux qui sont tous des spécialistes en mathématiques ou en sciences.

La recherche questionne le rôle de la technologie dans les processus d'évaluation formative et cherche en particulier pour des élèves en décrochage en mathématiques et en sciences. Ce projet international d'enseignement appuyées sur les recherches conduites par les partenaires, afin de faciliter les apprentissages fortement inter disciplinaire, et est axé sur le développement des pratiques d'évaluation formative utiles. Retrouvez la française du site FaSMEd et de la boîte à outils FaSMEd.

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French FaSMEd website:

<https://ife.ens-lyon.fr/fasmed>

FaSMEd “toolkit”:

<https://toolkitfasmed.wordpress.com>

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