USING TECHNOLOGY FOR FORMATIVE ASSESSMENT

HANDOUTS FOR TEACHERS

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Handout 1: Technology in the classroom

Which technologies are available for use in mathematics/science classrooms?

Which technologies can help you, the teacher, with formative assessment?

Technologies and formative assessment

Here are three teachers' ideas about which technologies can help with formative assessment:

Fred: "I use 'traffic lights' in my classroom. When I ask the children if they understand, they hold up a red light if they don't understand, an orange light if they are ok, and a green light if they are happy with the concept. Traffic lights are the main technology I use for formative assessment."

Archie: "We have a set of 'clickers'. These are quite versatile. The children can enter their answer to one of my questions and all the answers are displayed on the whiteboard. I can quickly see who doesn't understand. I can also see how many children don't understand.'

Jane: "I use a range of approaches in my classroom. It's not about the technology as such, though, is it? It's about my understanding of what my students are struggling with and what they can do. I suppose almost any technology could help me with that."

What is the main difference between Fred and Archie's responses and Jane's idea?

How can technologies contribute to the processes of formative assessment?

What is the role of the teacher in formative assessment (when technology is used)?

Can you suggest better questions to ask?

Handout 2: Technology and formative assessment

The FaSMEd framework

This framework was developed by the FaSMEd consortium. It takes into account three dimensions:

- five key strategies of formative assessment (introduced by Wiliam and Thompson, 2007);
- the three agents that intervene in formative assessment processes and that could activate these strategies, namely the teacher, the student and the peers; and
- the functionalities of technology.

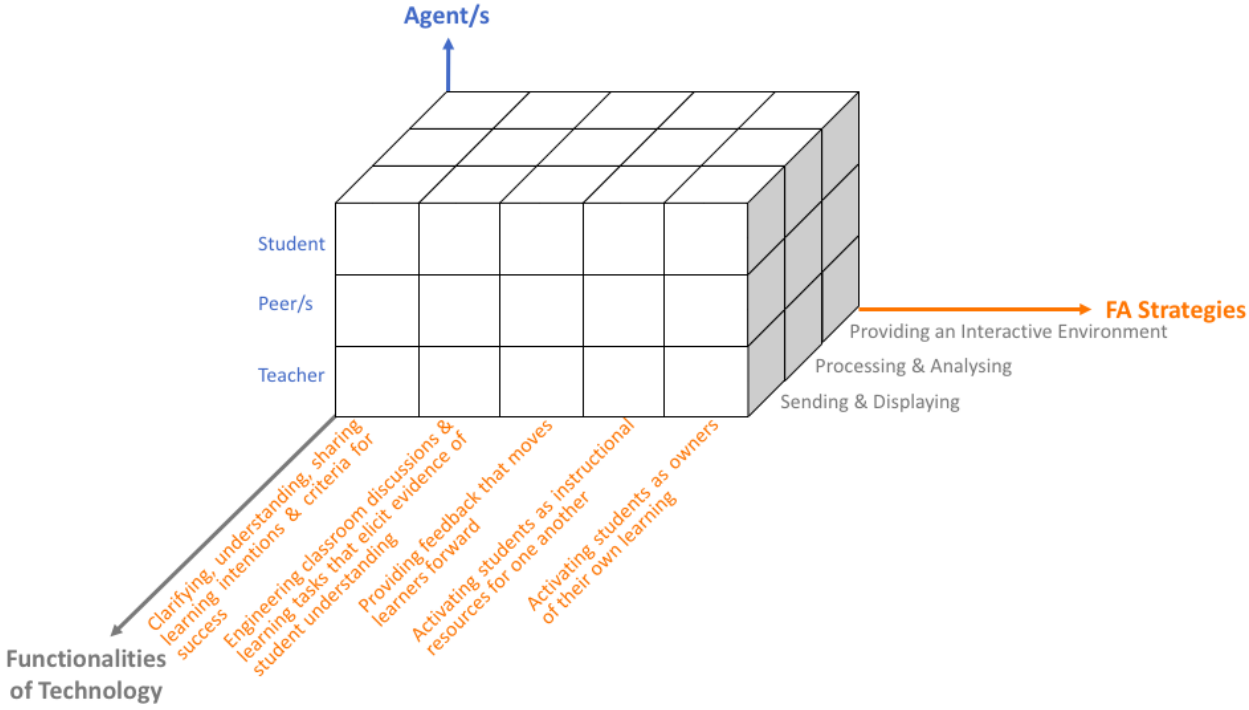

Figure 1: Overview of the FaSMEd framework

Think about the functionalities of technology in the framework:

- Sending and displaying
- Processing and analysing
- Providing an interactive environment.

Each of these will be discussed later. At this stage, consider the completeness of this framework.

Is there something missing in the framework? What is present and should not be?

Handout 3: Sending and displaying *during* a lesson

Which technologies could help you understand the current levels of understanding of individual students?

Which technologies could help your students to understand their own, or their peers', current level of understanding?

What issues arise when student work is displayed for the whole class to see?

A wide range of different technologies can be used in the classroom for students to 'send' teachers information about their current understandings. Some of these involve students' indicating how they *feel* about a given topic or concept as described by Fred in Activity A.

Others involve sharing work, such as an answer to a question. A familiar approach is to ask students to write their answer on the board (Figure 2). Posters made by students which can be viewed and discussed are another non-digital technology that can be used for this purpose. Nevertheless, digital technologies in particular offer many opportunities to make students' work visible. For example, the content of an individual student's device can be mirrored to the class screen by using certain software (such as AirServer or Reflector). Furthermore, a student's solution can be modified in real time using an interactive whiteboard (Figure 3).

Technology can also allow all students to share their answers with the teacher (or their peers) simultaneously, enabling the teacher to quickly assess who appears to understand the work and who is struggling. For this purpose, teachers in FaSMEd used mini-whiteboards (Figure 4) or "clickers" with appropriate software for displaying answers, e.g. Socrative (Figure 5).

Figure 2: A South African student writes her answer on the board.

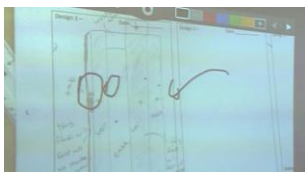

Figure 3: Student's work being displayed on an interactive whiteboard.

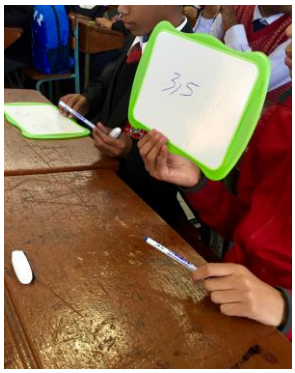

Figure 4: Mini-whiteboards being used in a classroom.

Figure 5: A 'Clicker' handheld for students to send their answers.

Handout 4: Sending and displaying *before* a lesson

How could you use technology to send work to students before a lesson?

How would you use student work, completed prior to the lesson, for formative assessment?

What issues should teachers consider when sending work to be finished prior to a lesson?

Teachers often ask students to complete a short assessment before teaching a particular topic, and they use the results of this assessment to help them make decisions about their teaching of the topic such as how to begin, what tasks to set for the class and what to emphasise. Lesson units designed for the Mathematics Assessment Project, for example, include a pre-lesson assessment, on which the teacher writes comments and questions designed to move the students on in their thinking. The students' initial responses inform the teacher's planning of the following lesson.

Digital technologies enable fast and easy communication, independent of location, between teachers and students or between peers. For example, in FaSMEd, some teachers saved work on Google Drive for students to complete at home. Students completed the work and uploaded their responses for the teacher.

Learning management systems such as moodle or Schoology (Figure 6) were also used by some FaSMEd teachers for formative assessment prior to a lesson. Students could post work and ask questions via chats, giving the teacher or peers opportunity to respond directly, before the next lesson takes place.

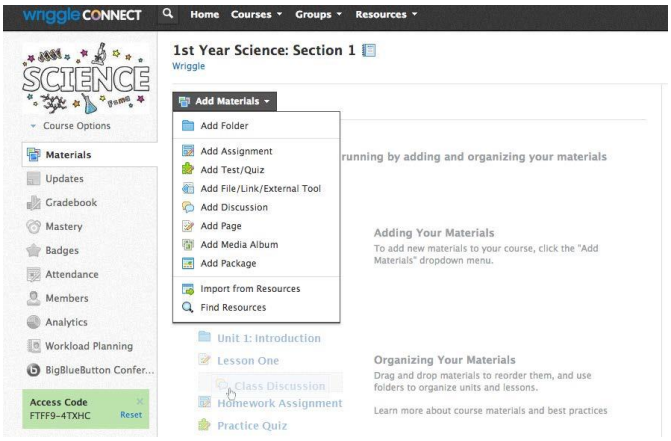

Figure 6: A sample page in Schoology.

Handout 5: Processing and analysing

Voting software, such as Clicker, processes the responses given by the students by checking them against the known correct answer. The software is able to analyse the responses student-by-student and also to aggregate the results for the whole class.

What are the benefits to you, as a teacher, of having information about how each student responded to each question?

*What are the challenges associated with having **so much** information available?*

Computer software is often able to generate feedback for students as they work on mathematics. There is some debate about what kind of feedback is useful for learning, what feedback is *formative*, and when feedback should be given.

Comment on the feedback generated by the computer in the two video clips each showing the screen activity of a student as she works through examples in Mathspace and DME.

Handout 6: An expert's views on using Mathspace

The main benefits of using the software for teachers

There were three main ways in which Mathspace facilitated formative assessment processes. Firstly, the program provided feedback directly to individual students in the form of 'hints' every time they entered their next stage of working. These 'hints' provided suggestions of what to think about rather than simply stating the correct 'answer'. The 'hints' provoked reflection by students on their strategies, challenged current thinking and encouraged re-thinking. Secondly, the system used an adaptive approach to generating subsequent questions. Students did not all work through the same set of questions but their individual responses automatically generated further questions of a similar or more advanced difficulty, as appropriate. The system therefore, used feedback from the students to make adaptations to their learning program. In addition, Mathspace provided the teacher with an overview of student progress in 'real' time so that they could at any time see what questions each student had completed and how close they were to a level of competence defined as 'mastery'. This enabled the teachers to identify where interventions were needed and provide timely individual support where necessary.

The system provided feedback to the students so that they could work independently for much of the time, either in class or at home. This meant less dependency on teacher feedback and more space for the teacher to focus on those who were struggling. The overview of progress also helped highlight common misconceptions that might require further work with the whole group.

The teacher could set the type of question and the parameters but the system generated questions without further teacher involvement. Even when students achieved the set level of 'mastery' further questions would still be provided. This saved time for the teachers in finding further work for the quickest students or alternatives for those who were having difficulty.

The main benefits of using the software for the students.

Since there was feedback from the system on each line of working (for the work I observed) then students did not waste time working through to the end of a question when an early error had been made. The students appreciated the immediate feedback from the system since this often enabled them rethink their ideas, correct their own thinking and make further progress without waiting for the teacher to provide feedback. This was particularly important when using Mathspace outside the classroom, although it clearly had similar advantages when used in class. Apart from the potential for them make faster progress due to the immediate feedback, it also encouraged independence and ownership of their own learning.

What advice would you give to teachers who want to use this, or similar, software?

Teachers need to think about what the software actually provides, where within the study of a topic it can be used most effectively, and how to integrate it with other approaches rather than rely too heavily on the software alone. For example, Mathspace seemed best suited to providing feedback and adaptive questioning when students already had some knowledge of the topic and needed to develop better fluency with a process. It would also be useful for revision of the topic. When using the software, teachers should be clear how this changes their role and how they will adjust to work with the system. They also need to think about the formative assessment processes involved and how the software feeds into these so that it is used effectively.

Handout 7: Providing an interactive environment (self-assessment)

The tool designed by the team at the University of Duisburg-Essen is designed to shift the responsibility for diagnosing areas of difficulty from the teacher to the student (with the help of the software).

What are the implications of using this software for your teaching?

How would your students respond to the software?

To what extent would you describe this software as formative?

Handout 8: Providing an interactive environment (examples from GeoGebra)

GeoGebra is an example of free interactive software, designed for the mathematics classroom. In the video, Daniel Pearcy demonstrates how to make tools which allow student to experiment and check their own ideas. This is followed by a screencast, showing a student working through a pre-designed worksheet.

What is the role of GeoGebra in providing formative assessment? How well can the technology 'do' formative assessment?

What is the role of the teacher?

Comment on the use of sliders for formative assessment.

Comment on the way the student worked through the pre-designed worksheet for formative assessment.

What sort of classroom norms would you need to establish in order to use GeoGebra in this way for effective formative assessment?

