

FaSMEd

Raising achievement through Formative Assessment in Science and
Mathematics Education

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FP7 research project

- Action: Science in Society (Research in the role of teaching methods and assessment methods in addressing low achievement in the field of Mathematics, Science and Technology) Collaborative Project
- Purpose: To research the use of technology in formative assessment classroom practices that allow teachers to respond to the emerging needs of learners in mathematics and science.

Timescale 3 years

The project FaSMEd has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 612337

Partners

University of Newcastle upon Tyne, UK (Coordinator)

The University of Nottingham, UK

Ecole Normale Supérieure De Lyon, France

National University Of Ireland Maynooth

University Of Duisburg-Essen, Germany

University Of Turin, Italy

Freudenthal Institute, University Of Utrecht, The Netherlands

African Institute For Mathematical Sciences Schools
Enrichment Centre , South Africa

Norwegian University of Science and Technology (NTNU)

Objectives:

- *A design research project*
- To adapt and develop existing research-informed pedagogical interventions (developed by the partners), suited to implementation at scale, through:
 - *fostering high quality interactions in classrooms that are instrumental in raising achievement;*
 - *Expanding our knowledge of technologically enhanced teaching and assessment methods addressing achievement in mathematics and science*

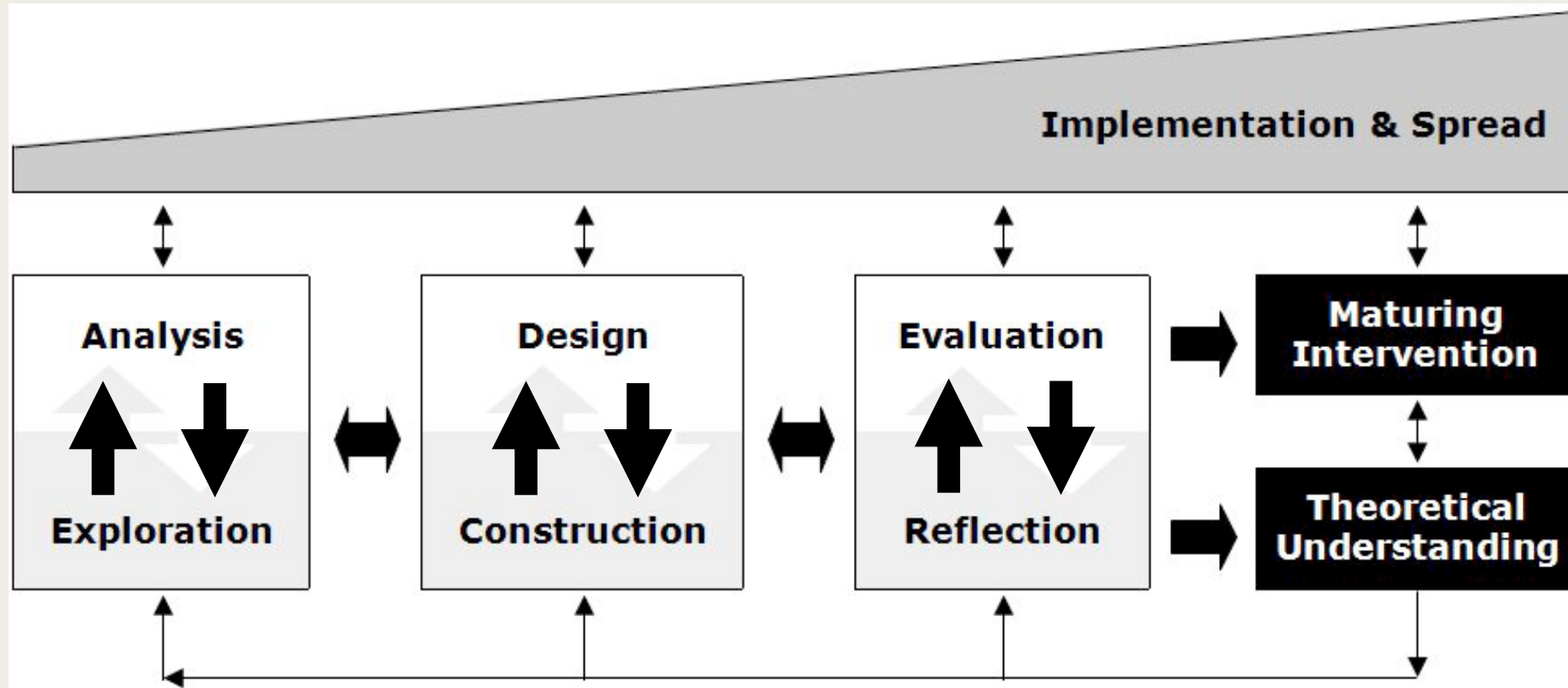
Deliverables:

1. Offer approaches for the use of new technologies to support formative assessment.
2. Develop sustainable teaching practices that improve achievement in Mathematics and Science.
3. Produce a toolkit for teachers to support the development of practice and a professional development resource to support it.
4. Country reports – case studies – comparative studies.

Design or “Engineering” Research

- Design-based research **is a formative approach** in which a product or process (or ‘tool’) is envisaged, designed, developed and refined through cycles of enactment, observation, analysis and redesign, with systematic feedback from end-users.
- **Educational theory** is used to inform the design and refinement of the tools, and is itself refined during the research process.
- Its goals are to create **innovative tools for others to use**, to describe and explain how these tools function, account for the range of implementations that occur and develop principles and theories that may guide future designs.
- Ultimately, **the goal is transformative**; we seek to create new teaching and learning possibilities and study their impact on end-users.

The generic process



McKenney and Reeves (2012)

Formative assessment - a process not a product – ‘Making learning visible’

“Students and teachers using evidence of learning to **adapt teaching and learning** to meet immediate needs minute-to-minute and day-by-day”.

(Thompson and Wiliam, 2007)

“... all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. **Such assessment becomes ‘formative assessment’ when the evidence is actually used to adapt the teaching work to meet the needs.**”

(Black & Wiliam, 1998, para, 91)

Key strategies for formative assessment – the framework for the toolkit

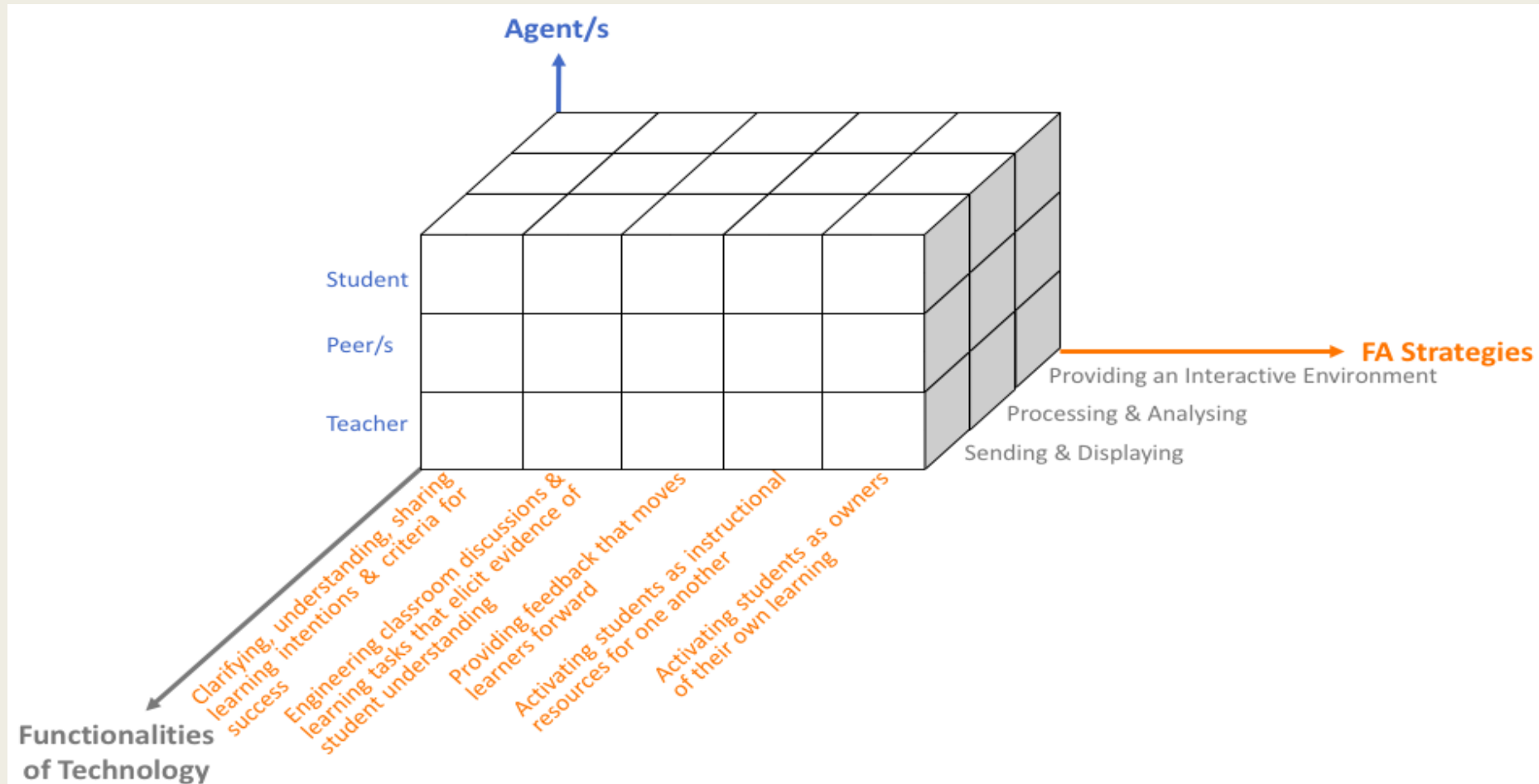
	Where the learner is going	Where the learner is right now	How to get there
Teacher	Clarifying learning intentions and sharing criteria for success (A)	Engineering effective classroom discussions, activities and tasks that elicit evidence of learning (B)	Providing feedback that moves learners forward (C)
Peer	Understanding and sharing learning intentions and criteria for success (A)	Activating students as instructional resources for one another (D)	
Learner	Understanding learning intentions and criteria for success (A)	Activating students as the owners of their own learning (E)	

William & Thompson, 2007

Functionality of tools for formative assessment

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

The FaSMEd framework – adding technology



The toolkit

“The expression ‘toolkit’ refers to a set of curriculum materials and methods for pedagogical intervention”

■Curriculum materials:

- *Assessment tasks that make teachers more aware of learning obstacles.*
- *‘Diagnostic’ tasks that make students more aware of learning obstacles*
- *Sample lesson plans that show how FA may be embedded to help overcome these obstacles.*
- *Examples of how technology can support these.*

■Processes for pedagogical intervention:

- *Professional Development modules*
- *Ways of using the PD modules*

Some emerging findings from case studies

- “The technology can provide immediate feedback, potentially useful for teachers and students. However, the usefulness depends to a large extent on teachers’ skills to benefit from it, as they often do not know how to helpfully build it into their teaching, in particular for using it formatively to benefit pupil learning.”
- “Technology appears to provide an ‘objective’ and meaningful way for representing problems and misunderstandings.”
- “The technology helped to raise issues with respect to FA practices (for teachers and students), which were sometimes implicit, but not always transparent to teachers. In nearly all the cases the connection of FA and technology tools helped teachers to re-conceptualize their teaching with respect to FA.”

more

- “Technology can provide opportunities for using preferred strategies in ‘new’ or different ways.”
- Different technological tools provide different “outcomes”: in principle, each tool can be used in different ways, and hence the instrumentation/instrumentalisation processes are important. (e.g. feedback to individual; feedback to groups of students; feedback to whole class and discussion) Often a mix of technology was used, and the “orchestration” of the technology tools needs particular skills.
- “Ergonomic factors appear to constrain the implementation and use of technology for FA purposes.”

The toolkit (in construction)

<http://www.fasmed.eu/>