Deliverable D3.5: Evaluate professional development package

The FaSMEd project aims to introduce and investigate the use of technology in formative assessment classroom practices in order to support and collaborate with teachers as well as raise student achievements in mathematics and science. Therefore, the development of a professional development (PD) package "that exemplifies [the] use of the toolkit" is a major objective of the project (FaSMEd DOW, 2013, p.3). The prototype of this PD package, as described in "Deliverable D3.4 Prototype professional development package for teachers: A prototype professional development package to support teachers in their use of the toolkit", is integrated in the project's toolkit website and consists of seven principles for effective continuing professional development (CPD) as well as six modules, "which explore some of the pedagogical challenges associated with using formative assessment effectively in the classroom" (D3.1, p.6; http://toolkitfasmed.wordpress.com/).

1. Types of PD approaches in FaSMEd

As proposed in deliverable D3.4, the organisation of PD activities vary within the project depending on the conditions in each partner country (D3.4, p.3).

All partners used an *active involvement of the teachers in the design-based research process* of FaSMEd as an instrument for PD. Teachers were involved through cluster meetings and school visits throughout the intervention phase of the project (2014/2015). These meetings included dialogues with the FaSMEd researchers, sharing of practice with other teachers as well as participating in the "design-do-review cycles" of classroom materials. This PD approach was organised very differently by each FaSMEd partner. For example, AIMSSEC discussed classroom materials with teachers and reflected with them in depth about the tasks, the approach taken in FaSMEd lessons and their own teaching as well as refining the materials based on the teachers' experiences in the classroom. Whereas ENS de Lyon, for instance, left the responsibility for designing lessons to the teachers. Then the researchers observed and analysed lessons and discussed them with the teachers. The redevelopment of classroom materials was performed by the researchers based on these analyses and discussions. In addition, their work with teachers involved the development of a French toolkit website including all adaptions made to the classroom materials.

Another PD approach used by two FaSMEd partners (UNEW and UNOTT) involves the implementation of *professional learning groups (PLG)* (also this could be referred to as a 'community of inquiry'). For example, UNOTT organised groups of three teachers to follow three cycles of planning, implementing, observing, discussing and revising for each FaSMEd

lesson. This included teachers observing each other's practice in the classroom and generating feedback for their peers.

PD courses were used by four partners. While UNEW and DUE met with teachers for a one-day training programme at the beginning of the project in order to inform teachers about the project and educate them about formative assessment, NUIM and UU designed a number of PD sessions for their teachers. NUIM held four 3-5 hours long PD sessions with teachers over their academic year 2014/2015. These sessions were followed up by school visits and classroom observations. Between sessions teachers shared their reflections and student work in the online learning environment *Schoology*. UU designed a PD course consisting of three meetings with a cluster of schools (3 schools for the second pilot study and 25 schools for the ongoing main experiment). The meetings involved discussions on the output of the developed *DAE materials* (see D3.2 for more information on the Digital Assessment Environment (DAE) materials) with researchers and other teachers as well as generating ideas for further teaching based on the teachers' findings.

Five FaSMEd partners implemented the *materials from the prototype PD package modules* in their PD activities with teachers. For example, UNITO introduced these materials in meetings with teachers from the same school as well as cluster meetings, which involved all the teachers, that were organised to (a) share, analyse and discuss classroom materials, before and after the implementations in the classes, (b) discuss the potentials of the chosen technology for formative assessment and (c) reflect about a possible re-design of activities and of the use of technology during lessons.

2. Efficacy of the PD approaches in FaSMEd

Analysing the efficacy of the PD approaches is a core aim of FaSMEd. Due to the specific conditions in each country and regions, there are differences in the partners' implementation of PD (see above). As this is an interim report, we are giving an exemplarily overview. First findings can be described as follows.

Based on the teachers' feedback, teacher interviews and the researchers' observations of lessons and meetings as well as the observed extent to which teachers adjusted lesson plans, the teachers' attitudes and beliefs were registered. The teachers valued the increasing collaboration between themselves because it provided them with opportunities to learn from each other. Furthermore, teachers valued the input and advice from the FaSMEd researchers and recognised the potentials of the classroom materials. In addition, some teachers have shown or stated a change in their teaching, especially in regards to their approach on classroom discussions and examinations. Nevertheless, these PD activities worked well where it fitted into a school culture of collaboration and active engagement with lesson design and review but less where teachers had to find extra time to engage in the design-based research process or were under pressure to "perform" as individuals in the classroom. Moreover, some teachers declared that they had difficulties in autonomously using technology in the classroom, so that this should be focused more in the work with teachers. Based on the Meta-

Didactical Transposition model (MDT, Arzarello et al., 2014) used by ENS de Lyon to evaluate PD, the PD activities can be described by praxeologies that consist of the praxis as well as referring to a certain theory. In the collaboration between teachers and researchers, the researchers' praxeologies based on theoretical frameworks encounter the teachers' praxeologies based on their professional knowledge. As a result of this collaboration both teachers and researchers internalize the others' praxeologies as their own, therefore learning from each other. It was determined by the researchers from ENS de Lyon that teachers were not familiar with the concept of formative assessment or the use of technology with its functionalities of "Sending and Sharing" as well as "Processing and Analysing" prior to their work in FaSMEd (see FaSMEd Framework). The teachers' evolved praxeologies in these two areas - formative assessment and the use of technology - thus, can be considered evidence of PD.

What needs to be considered is that this approach to PD is very difficult to arrange as it requires a lot of time and organisation from both teachers and researchers. A more flexible organisation of meetings is therefore advisable. However, the question can be raised weather the PD is not a specific aim but more of a by-product of the design-based research process. Therefore, this approach might not be an effective way to provide scalable or sustainable PD.

Regarding the PD courses, FaSMEd partners describe the efficacy as follows. Based on teacher feedback, classroom observations, student feedback and the interaction between teachers on an online platform, the PD course held by NUIM was effective in ways that:

(1) Workshops were interactive and activity-based, encouraging participants to develop their own thinking on formative assessment and collective professional learning,

(2) Workshops focused on pedagogical practices to enhance student learning,

(3) Key readings were provided to participants to engage with research underpinning the pedagogical practices advocated in order to promote reflective professional enquiry,

(4) Participants were encouraged to share practice in both a formal and non-formal way during PD events to encourage collaboration focused on learning and teaching,

(5) Workshops were tailored to suit the needs of the participating schools but were at all times focused on formative assessment in order to optimise resources and structures,

(6) Participants were encouraged to think and plan how they could develop formative assessment to build on existing practices and to explore new practices using a plan, do, review, redo cycle,

(7) Participants were encouraged to discuss FaSMEd classes with their students and to be explicit on formative assessment skills they were developing so that students were focused on their own role in learning, and

(8) Participants were encouraged to view each other's practice and to give feedback so as to promote mutual respect, trust and support.

The efficacy of the PD course developed by UU was evaluated based on teacher questionnaires and student performance as indexed by the use of the national Cito Mathematics test in the Netherlands. The second pilot showed that teachers generally find the PD meetings useful and develop interesting insights from assessing the students' work generated in the *DAE*, but could not use these insights formatively due to the lack of time at the end of the school year. Nevertheless, preliminary reports from teachers from the main experiment (ongoing) suggest that, at an earlier point in the schoolyear, teachers are more capable of adjusting their teaching to the information collected using the *DAE*.

Lipowski and Rzejak (2012) state that PD activities can be effective on four different dimensions: the first is the acceptance of the PD activity among teachers, the second dimension consists of the effects that the PD had on the professional competencies of the participating teachers, third are the consequences for the teachers' actions in the classroom and the last dimension describes changes in student achievements. Referring to these dimensions, the efficacy of the FaSMEd PD approaches can be described as follows:

(1) Acceptance of PD among teachers:

As described above, teachers were generally very accepting of the PD activities of FaSMEd. Many stated that they find the developed classroom materials useful and would use them again in their lessons. They were satisfied with the introduction to new examples and technologies. Furthermore, they enjoyed the collaboration with researchers as well as other teachers and state that it has changed their way of teaching. In the case of NUIM, teachers highlighted how the FaSMEd approach varied from previously attended PD courses as it focused less on subject specific activities and more on developing their formative assessment practices in all classes.

(2) Consequences of PD for teachers' professional competencies:

Teacher interviews showed that engaging in the project and carrying out FaSMEd classroom materials did have a short term impact on teachers' professional competencies. Participants stated that they learned a lot about the use of technology to assess students' learning and improved on their questioning in classroom discussions. Furthermore, the teachers' feedback improved and it was stated, that they learned about implementing their findings on students' learning in upcoming lessons. What is more, many teachers changed their perspectives by recognizing the value of finding out what learners know and using it to foster their learning. This includes recognizing the effectiveness of the FaSMEd framework as a tool to analyse their lessons.

(3) Consequences of PD for teachers' actions in the classroom:

Changes in teaching were noticed during the FaSMEd researchers' classroom observations. Teachers altered their actions in the classroom from their usual practice during FaSMEd lessons. Moreover, their lesson planning got more detailed and anticipated students' responses as well as possible questions and prompts. In addition, teachers used new technologies in the classroom. Furthermore, teachers stated that they use FaSMEd lessons in other classes or that engaging in the project has changed

the way they develop and use examinations. In many cases, the teachers' experiences with the classroom materials lead to a revision and enhancement of these materials.

(4) Changes in student achievements:

It could be observed that students were highly engaged during FaSMEd lessons and seemed more focused. Some students reported that the lessons made them think and learn from their peers. Moreover, teachers recognised that students took more responsibility for their learning and became more self-confident as well as increased their interactions between each other during lessons. A quantitative analysis by UNEW showed no significant difference in the achievement between FaSMEd classes and others. However, teachers reported some surprising examples of retention and understanding among lower achieving students on topics covered by the FaSMEd activities. There was also evidence that students got better at working independently and in groups as well as finding different ways to get help rather than just asking the teacher. In the pilot study from UU, changes in student achievements were visible, but did not differ significantly from national averages of changes in scores.

3. Consequences for the final PD package

The PD approach to integrate teachers in a design-based research process is effective in the ways explained in section 2, but requires a lot of organisation and intense work as well as constant exchange between teachers and researchers over a long period of time. Some of the communication required could be organised in a more convenient way by using technologies as seen in the case of NUIM using the online platform *Schoology*. Furthermore, teachers should be encouraged more often not only to use the FaSMEd classroom materials, but contribute their own ideas for planning formative assessment lessons. In order to keep the teachers' attention focused on formative assessment processes and in order to monitor their progress, UU used questionnaires that were completed by teachers each time they used FaSMEd classroom material. Such a questionnaire for teachers could be integrated into a PD package because it can help teachers to monitor their work and adjust their practice to the students' needs more easily.

As the final PD package aims to advise teachers, who were not previously involved in FaSMEd, on how to use the toolkit, it is important to think about a clear structure for the PD package as noted by the Technical Review Report of the project (Technical Review Report, p.4). It needs to be decided by the consortium, which information is presented to the teachers, and in what way. The integration of examples of the work of FaSMEd partners with teachers in the PD package could help not only teachers to understand how to use the classroom materials, but provide teacher trainers with a possible method of practice. For the same reason, FaSMEd partners who already designed PD courses and workshops (NUIM and UU) or intend to do so (DUE and AIMSSEC) should provide the PD package with a description of their work.

Furthermore, it is important to emphasise the role of technology in the work with teachers (D9.1, p.3). This will be achieved more easily when the classroom materials of the final toolkit describe the connections between formative assessment, classroom practice and

technologies. In addition, these connections will be in focus once the toolkit structure is rebuilt based on the FaSMEd framework (see deliverable D3.2 for further explanations). Moreover, the integration of case studies will inform teachers on different ways to use technology for formative assessment purposes.

4. Resources

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Prototype Toolkit: https://toolkitfasmed.wordpress.com/.