FAMT&L

FORMATIVE ASSESSMENT IN MATHEMATICS FOR TEACHING AND LEARNING

Work Package 3 - *Educational/learning needs analysis: practices of teaching and formative assessment of the mathematics' teachers*

Deliverable D3.4– Selection and indexation of data for construction of the web repository

Start date of project: 01/12/2013 Duration: 36 months

Lead organisation for this deliverable: **University of Cergy-Pontoise (UCP)**

Deliverable number	D3.4		
Title	Selection and Indexation of data (video analysis, tools, …) for construction of the web repository		
Type of outputs / products / results	Definition of training needs of the teachers indication of situations / methodologies / tools may be used in the construction of the repository.		
Delivery date	M15 (Dec 2015)	**Dissemination level**	**X** Public ☐ Restricted to other programme participants (including Commission services and project reviewers) ☐ Confidential, only for members of the consortium (including EACEA and Commission services and project reviewers)
Nature	☐ Report ☐ Service / Product **X** Demonstrator/ Prototype ☐ Event ☐ Other		
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Description (limit 1000 characters)

Built from a sample, the trainer-researcher defined a tool to cross analyse teachers' competences in action (video recorded). This tool has been previously tested in several contexts. The tool is characterized by some specific validated behavioral categories that oriented the pilot training courses purposes and structure.

This document is a brief description of video collection which have been analysed to obtain data about the use of the formative assessment by teachers

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1 Introduction

This document aims to show the tool defined by FAMT&L partners to analyse the video collected and to be used in the teacher training course.

As showed in more deliverables and reports, the research started with observational studies and surveys in order to understand analytically Mathematics teachers' and students' beliefs and practices. The aim of this survey was to detect training needs to design specific courses aimed at promoting a correct use of methodologies and tools to conduct correct formative assessment activities.

During the first explorative phase of the work, with the administration of questionnaires, also some case studies, with the help of video recording, were conducted to develop and try out an observational tool (a structured grid) to analyse assessment practices in the classroom.

In the second phase, research group has carried out a systematic observation study on a larger sample of video sequences of teachers in four Partner countries (it was not possible in Netherlands) with the use of a specific tool. The tool was defined by using indications from international literature and experiences of in-service training and it was useful to gather many different indicators on good and bad practices for the formative assessment of Mathematics teachers (e.g. their habits about gathering information on the students' learning process, correcting errors and using feedback to support learning).

With the videos collected about formative assessment situations, researchers created a web-repository and designed a training program based on the use of such repository aimed to promote formative assessment in the practices of in-service Math teachers.

2 A tool to analyse the video

The long and complex work of making the analysis grid involved all partners. Specifically, they started doing several attempts and hypotheses to produce a list of descriptions of situations. Overall consensus was that this list cannot be exhaustive and foresee all the meaningful possible situations in assessment moments and, for this reason, the grid has to be considered "open" for future addition, comments and notes.
To begin with, the partners considered the experience in video-analysis that the University of Cergy-Pontoise (Paris) led over the years. With their support as a starting point, researchers carried out a study of the most well-known software systems (both free and not) that are available for the analysis of human behaviour with the help of video recording (for example The Observer XT by Noldus Information Technology, or iCoda, only for Apple computers, and the free software Transana and Anvil). To know better in detail, please see deliverables D3.1 and D3.2.
Examining several software it has been possible to realize a specific system for FAMT&L. That system is integrated in the web repository (see deliverable D5.2) which allows, on one hand, to gather the videos which have been endowed of metadata and analysed into a sort of on line catalogue which allows to search easily and find the archived material using different criteria of searching. This metadatation is also very functional to gather quantitative data for statistics elaborations on macro-level, since it allows finding the total number of videos containing a particular value of some indicator. On the other hand, this online system also permits to get an easier visualization of video sequences, of the categories used, to label them and of behaviour indicators that can be observed in the video itself.
Thus, researchers collected a number of videos recorded in classroom in school grades corresponding to ages 10-16. Then they extracted from these videos a large number of short sequences that had been analysed and stored in the repository and used in training courses specifically directed to in-service Math teachers.

Overall, the use of the grid for the video analysis was important, as it allowed gathering information on assessment practices. This work helped archiving and categorizing of video sequences that have been possible to use in pilot training courses.
This grid has been revised in time and it was subjected to "additions", above all additions to the list of observable indicators. In fact the researchers were able to complete and validate it via the systematic use of it in video-analysis, hence in observing specific actions and behaviours of teachers and students in class, during processes of assessment.

To describe the grid, we can say that its structure is at different levels. At the first level we have the data useful to "identify" and archive the (long) video files: Video's identification code; Country; Language; Type: audio/video (length, format); Creation date; Author; School level target; Number of pupils in classroom, Presence of students with particular educational needs.
On a second level we find categories which allow a qualitative analysis, because it contains a list of variables which get into play in a specific process of assessment, obtained by taking an environmental perspective (Bronfenbrenner, 1979).
The different indicators on assessment practices of Mathematics teachers in the grid are grouped in five macro-categories:

1. Mathematics' contents (contents and capabilities which are the object of the teaching);
2. Time of assessment (before, during or after a specific learning activity);
3. Setting of assessment (with all the students in the classroom, with groups of students or with each individual student);

4. Kind of tools for data gathering of students' skills (written tests, oral exams, behavioural observation, ...);
5. Phases of formative assessment (presentation of the assessment activity; gathering of information; correcting errors; feedback).

About the Mathematics contents (the first category), we considered not only contents in mathematical knowledge (Mathematics objects), but also the skills that the students put into play in the learning process. With a view on the complexity of the teaching-learning process, in fact, we adopted a two-dimensional frame contents/capabilities, a scheme based on the OECD-Pisa approach (OECD-Pisa, 2013). Specifically, for the contents: Numbers; Spaces and shape; Uncertainty and data; Relations and functions. For the capabilities: Communication; Mathematizing; Representation; Reasoning and Argumentation; Devising strategies for problem solving; Using symbolic, Formal and technical language and operations; Using mathematical tools.

The second (time: where the assessment activity takes place in the longer time of the whole lesson) and third category (setting: space/context of the formative assessment) categories include important variables, because both can condition the didactic process. These categories have to be pedagogically planned and suited to the specific learning situation, for having a very positive role in facilitating the learning process.

The tools (fourth category) that the teachers use in their assessment activity are very important too for guaranteeing a correct and rigorous evaluation. Specifically, they have to be suitable and functional to gather data on what the students have learned.

The last category is perhaps the most interesting and the most characterizing for the tool/grid, because it gathers several kinds of behaviours and actions which can be considered as indicators to be observed in the different phases of the assessment procedure. In this section some sub categories are grouped, one for each phase of the assessment procedures:

presentation of the assessment (when the teacher share the correction and/or assessment criteria with the class)

administration of the tools/strategies of assessment

collecting data

formative feedback (when the teacher give back the results to students)

To better understand the type of indicators contained in this category, a brief extract of the grid (in its section n. 5) is displayed below:

5.1 Presentation of the assessment

5.1.1 Sharing the correction and/or assessment criteria with the class

- *The teacher fixes with the students the date for the assessment*
- *The teacher reminds the class that today is the day of the assessment*
- *The teacher shows to the students the aims of the assessment*
- *The teacher asks some questions to the students to verify if the students understood the aims of the assessment*
- *The teacher shows to the students the subject of the assessment*
- *The teacher shows to the students the evaluation criteria to correct the test/task*
- *The teacher explains the test/task instructions*
- *The teacher asks some questions to the students to verify that the students understood the test/task instructions*
- *The teacher recalls the criteria to correct the test/task*
- *The teacher discusses with the students about the above criteria*
- *The teacher keeps care the student's observation about the criteria*
- *The teacher makes clear the ranking for each question*

Our analysis tool has been revealed to be very useful and also well implemented. It has been presented in some International conferences (as EAPRIL 2015 and ATEE 2016) obtaining many

consents. It has been integrated in the online repository (see D5.2) which contains short analysed extracts from the videos, so it makes the analysis itself easy and the metadata to insert in the videos, which can be found using single “words” of the grid as research and gathering criteria.
To view the full grid, see the Deliverable D3.1.

3 Videos for teacher training on assessment: web repository and e-learning platform

In order to allow the systematic use of videos and other materials in pilot courses for in-service teachers training from the several countries in the project, researchers planned to use also a platform (Espace) which permits to supply formative routes both on line and face to face. In this learning environment (e-learning platform), different types of tools for teachers could be available: theoretical materials, examples of learning contexts, video situations of Mathematics teaching, assessment tools, training courses, and so on. All these educational materials can be used to promote a proper use of formative assessment in teaching-learning situations.
The FAMT&L project was also oriented to design a model of training course for Mathematics teachers to improve a correct use of formative assessment practices (see deliverable D4.1). During the project, one or more pilot courses have been tested in every country with in-service teachers adopting the common training model, to which the different materials (in different languages) have been adapted. Our perspective is that those materials and courses could be adapted more specifically to different contexts and also be used in forming the future teachers’ teaching and assessment practices.
The training program was based both on teaching general knowledge related to didactic design and assessment practices, and on specific knowledge of Mathematics education, with particular regard to formative and summative assessment, and assessment for learning. In fact, the FAMT&L main principle is that the appropriate use of correct FA methods and techniques is a key element to make Mathematics teaching more effective and innovative.
During the pilot courses teachers accessed the web repository to view, analyse and reflect on video contents.

4 The use of videos in the teacher training

The theoretical framework for the phase of pilot training courses inserts in the international debate on teacher professionalism (Perrenoud, 2002; Anderson, 2004; Darling-Hammond & Bransford, 2007; Koster & Dengerink, 2008; European Commission, 2002, 2003, 2005, 2012; OECD, 2005; UNESCO, 2005) and their training as a strategic factor to improve the national educational systems (see Richardson & Placier, 2002; Darling-Hammond, 2006; Darling-Hammond et al., 2007; Coggi, 2014). In particular, FAMT&L researchers studied the debate about the important relationship between theory and praxis, between knowledge and competences, and in particular the attention is on how to get that the information obtained will really develop into new behaviours and competences that will enter into play in their everyday teaching practices.
In this line of thought, it is particularly relevant the concept of recursivity between theory and praxis, which allows to translate theoretic knowledge and methodology into action and also, at the same time, reflection on the action itself (a reflection that, in turn, becomes new knowledge, and so forth).
Many interdisciplinary studies have aimed to point out the crucial factors in teaching behaviours

in order to valuate and promote effective teaching methods.
From these studies several indications result about the most effective methodologies to promote the co-presence of theory and praxis in teachers training (both in-service or pre-service) and about many techniques that can be based on the use of specific support tools, as, in particular, the videos.
More specific, methods that make use of video in training are classified as "media education" (O'Reilly, 2005) and in particular those which are addressed to teachers can be distinguished depending on the specific use that is made of the video (Masats & Dooly, 2011):

- as both an object and a tool for observation and analysis, to show a subject to the teachers (we speak of video-viewing, in this case);
- as an example or display, when the video shows the practices and the behaviour of experienced teachers in specific situations (video modelling);
- as a record of teachers themselves, which is shared with the others, making it an occasion of comparison and debate with colleagues or with a trainer (video coaching).

Content, length, aim of a video can be various. For example, a video can be presented as an example of everyday teaching activity (Carbonneau & Hétu, 2006; Clarke et al., 2008), or as a "best practice" which rarely could be directly observed, or as a specific experience or experimentation (Santagata & Guarino, 2011).
Many studies seem to confirm that the video-based interventions in the training of teachers are very effective: videos are used as a tool able to integrate and support, via the visual activity, the direct observation and the learning of good teaching practices of which, otherwise, there could only be a description, oral or written (Santagata, Zannoni & Stigler, 2007).
For instance, we can refer to a technique used actually, based on experiences made in the '60-'70's by K. Romney and D. Allen at Stanford University. This is the technique of microteaching which consists mainly in having the trainee teacher to present to a small group of students a short time teaching session, concentrated on a specific subject. The short session is monitored from trainers which use video recording as main tool. The trainees, analysing a teaching sequence, can reflect asking themselves about the abilities which will help them to solve a specific problem in teaching practice and about the errors they can do in their activities. Such an analysis can promote and facilitate a reflexion on what is done in the class, which contributes to an improvement of the teaching practices.
Therefore, the reflexivity as an attitude of the teachers to analyse and think over about their own practices is essential to get an educational success (Dewey, 1961), and it is what allows us to speak on the teachers as reflective practitioners (Schön, 2006; Damiano, 2007).
It is also important that this use takes place within a well-structured educational path, characterized by

- a clear and thought over choice of the learning objectives that one wants to achieve with the trainees teachers (Blomberg et al., 2013; Seidel et al., 2011; Rossi et al., 2015);
- the production or selection of the videos best suited to the defined objectives;
- a good support and guide to the vision, comprehension and analysis of the video;
- elaborating suitable tools for evaluation, appropriate to the objectives (Calvani et al, 2014).

Following these ideas, the FAMT&L project aimed to the elaboration of a pilot course for Mathematics teachers that could be followed in part as a distance course and in part face to face. Such a course should integrate and use the analysis of videos made in class with teachers involved in the project with different modalities, but all oriented to the achievement of specific formative targets.
Using the video stored in the web repository, researcher intended to promote a training process in which the observation of teaching practices by themselves could allow changes in teacher' behaviour and encourage them through critical thinking a reconsideration on assessment and teaching. In fact, the pilot course that had been developed uses video sequences analysed in

order to promote critical thinking of teachers in training.
The model of the course had been tested and its efficiency verified with small groups of Mathematics teachers in the several partner countries, so that it can be proposed as a model to be adopted also in other activities, both for in-service or pre-service teachers.

4.1 The pilot course: training model and activities

To have a more clear view on the development of the training course, please see Deliverable D4.1. In this section we want to show some indication for the use of videos in the training.

The common application model was created by defining a series of essential elements that should be contained within each pilot course.

From a methodological point of view it has been important to establish that, in all the courses, there have to be moments of discussion and reflection of teachers on video and on the construction of the formative assessment concept using video and the web repository then.

In general, the training program has to be based both on teaching general knowledge related to didactic design and assessment practices, and on specific knowledge of Mathematics education, with particular regard to formative and summative assessment, and assessment *for* learning:

- Using a common template for all project partners, characterized by elements of an arrangement of learning activities combining the theoretical content and teaching.
- Practical content founded on direct experience of action and reflexive processing
- Interventions by university teachers, supervisors, mentors or critical friends (teachers experts and already partly trained on the topic participating in the course as critical friends).
- Proposals for communication, analysis, discussion and reflection centred on issues related to
    - development of evaluation practices
    - the development of data collection tools
    - the preparation of concrete experiences and practices
- Documentation to be used through a number of stimuli and reflections / discussions shared and applied in the virtual environment.

In fact, it is also important to emphasize the use of strategies and methods drawn by research experiences that show how the video recording for educational practices becomes even more incisive if intertwined reflection and dialogue provoked by questions-stimulus guided by a researcher / facilitator or by the use of tools such as drills and tasks with questions stimulation or learning diaries that guide the subject to a meta-cognitive level (Filliettaz 2014)..

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