The Use of Videos in the Training of Math Teachers: Formative Assessment in Math Teaching and Learning

Integrating Video into Pre-Service and In-Service Teacher Training

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Chapter 7
The Use of Videos in the Training of Math Teachers: Formative Assessment in Math Teaching and Learning

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ABSTRACT

The purpose of this chapter is to present a systematic observational research on the math teachers' assessment practices in the classroom. This research is a specific phase of an international project (FAMT&L - Comenius Multilateral Project) and it is aimed to promote the use of formative assessment in teaching mathematics to students aged from 11 to 16. The observational study is carried out by a plan of systematic observations of teachers' behaviour in the classroom with the help of video recording. Thanks to a specific tool of video analysis (a structured grid), developed using indications from international literature and experiences of teacher training in the five Partner countries involved (Italy, France, Holland, Switzerland and Cyprus), we managed to gather many different indicators on good and bad practices for the formative assessment of mathematics teachers. Furthermore, the analysed video will be used in in-service teacher training courses in order to promote a correct use of formative assessment and to improve achievements in learning mathematics.

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FRAMEWORK ON FORMATIVE ASSESSMENT IN MATHEMATICS TEACHING AND LEARNING[1]

Assessment in classroom has always been a key tool in order to promote, or to hinder, democratic values at school. An education system that does promote quality and equity for the learning achievements of its students, uses assessment as a key element to qualify the action of teaching in a democratic way, both at the beginning and during the process of teaching-learning; moreover it will consider the differences among the students and their possible learning difficulties as opportunities to make the teaching actions flexible in order to reach goals of quality for all (Vertecchi, 1976; Grandi, 1977; Weeden, Winter, & Broadfoot, 2002).

As we can read in Crahay and Issaieva (2013), it has to be a kind of assessment which adheres to a principle of equality of achievements (Bloom, 1968; Black & Wiliam, 1998; Guskey, 2005), hence to an idea of "fairness" in teaching, by offering more to whom possesses less.

This need of fairness in achieving the competences for citizenship (OECD, 2012; 2015; Eurydice, 2012) is more evident in every education system when considering basic competences and at high and junior high school level, before the completion of the compulsory cycle of studies. In particular, relevant problems appear in the field of math teaching, with important gaps in the conduct of the specific teaching-learning processes.

ASSESSING MATHS LEARNING: A DIDACTIC AND A SOCIAL PROBLEM

In Italian school practice, the assessment of Mathematical learning has been and in fact is yet traditionally oriented to a summative function, performed by means of written open tests (only recently the use of multiple choice tests is increasing) and oral-at-the-blackboard interrogations. Hence, is focuses primarily on students' *products* (results of calculations, presentations of proofs, …). On the other hand, formative assessment, as it will be detailed below, requires being careful mainly of students' *processes.* In this sense, we may say that in Italy math teachers have no formative assessment tradition, and in fact there is no systematic presence of it in pre-service training, and it is sporadic also in in-service training.

It must be noted that assessment, in math, has a crucial role in determining students' beliefs and attitudes, which in turn influence students' achievements (Di Martino & Zan, 2002; Bolondi & Ferretti, 2015). Therefore recovering a formative dimension for assessment is a strategic goal for maths teacher and it may became a fundamental tool for switching all the didactic focus from the contents (the mathematical objects) to the actors (the students).

Maths activity in the classroom involves many components: discourses, technologies, visual representations; it is performed through explorations, work on specific tasks, explanations. Formative assessment takes place in this complexity of actions. Then it is important to train teachers to observe significant elements of this complexity, and for this purpose video analysis is a natural tool.

As examples of situations that are worthwhile to analyse, we may list:

- Administration of a written task, with discussion about it (the content, the form);
- Administration of a written task, with explanation of the objectives of the activity;
- Administration of a written task with the explicitness of the evaluation criteria;
- Individual interview with the use of tools of observation and interaction;

- Self-assessment, written or oral;
- Classroom time devoted to peer assessment with shared criteria (for instance, Group A evaluates and discusses the tasks of a student of Group B, better with no crossing);
- Classroom discussion about the feedback of written test of formative assessment;
- Interaction among the class, the teacher and the student interviewed during an individual interview;
- Discussion groups in the class about a problem;
- Discussion in a group on the feedback of a task performed by the group;
- Discussion at the end of a task;
- Students' or group's reports of a performed task to the class;
- Return of a corrected task, with explanation of strengths and weakness points of the student.

Formative Assessment: A Support to Promote the Processes of Teaching-Learning

Since its origins (Scriven, 1967; Vertecchi, 1976), the main function attributed to formative assessment (FA) has been to use it as a regulator tool for teaching and learning.

Referring to the current international scientific debate on this issue, we can say that formative assessment is characterized specifically as an assessment *for* learning (Weeden, Winter, & Broadfoot, 2002; Allal & Laveault, 2009). This means that it has to be an assessment which is functional to backing up and promoting learning; it is embedded in the teaching-learning process in a dynamic way, modifying the teaching actions by following the needs of the students. The aim will never be just to attribute marks, or to make a résumé on the abilities of a student; formative assessment helps a teacher to gather information, to improve and make her/his teaching more effective.

Thus, when a teacher uses formative assessment, s/he is implementing two fundamental actions (Vertecchi, 1976):

- A diagnostic analysis of the achievements (knowledge, abilities) that the student is acquiring and which meta-cognitive strategies the student is following;
- Reconstructing the teaching routes by following the student's needs and differentiating times and methods of the didactic process.

Thanks to this diagnostic function, formative assessment analyses the learning situations and can give information in order to take coherent and effective decisions. It focuses on the "errors" of the student and of the teacher, by considering them as resources for designing and re-designing interventions in view of the teaching goals.

This kind of assessment which has to be implemented *continuously* during the teaching process requires a high level of professionalization of the teacher. Such as a coach in the training of an athlete or a team (Bennet, 2010; 2015) who proposes activities and tasks to the trainees (as a trial for their abilities), detects and immediately corrects their errors (by discussing with the trainees about them), understands the specific needs and gives formative feedback.

As every assessment procedure (Gattullo, 1967), also FA is characterized by three steps (Gitomer & Zisk, 2015, p.3):

- An initial step of cognitive representation of which data we want to collect ("what we are trying to measure");
- A step of specific gathering of data, by empiric observation ("how we collect evidence");
- The interpretation of the data ("how we make sense of the evidence").

Collecting evidence is an unavoidable phase (Ruiz-Primo & Furtak, 2004), inasmuch as it characterizes FA as a specifically evaluative action, either if it is formally or informally done (informally as in the course of a teacher's day-to-day activities) (Bell & Cowie, 2001; Duschl, 2003; Shavelson et al., 2002). Without a willing gathering of evidence we would not be doing FA, but just a teaching activity.

The next step, data interpretation, is equally important. Doing summative assessment this step would end in the attribution of marks or of a judgment, doing FA any judgment is suspended. It is formative feedback that must take place in this moment, instead: the teacher's answer to the needs/requirements of the student. Researches show that feedback – together with FA – is the crucial element, which contributes, in a statistically significant way, to improve the results in the students' learning (Hattie & Timperley, 2007; Hattie, 2009; 2012; Huelser & Metcalfe, 2012).

For this reason, the teacher's practices in class are particularly important, both in the moment when data about the students' achievements are gathered and analysed, and when interpreting the data, elaborating hypotheses about the kind of mistakes the students do and implementing feedback actions to help them in the critical steps in their apprehension. All this is really fundamental in the teaching of mathematics.

The feedback activity is a complex set of actions by the teacher, not easily described by a set of rules or given operations; for this reason, research in this field are particularly relevant and stringent: it is necessary, in fact, to clear up, in detail, which are the most effective conducts that the teacher has to implement in classes activities when facing a "stumbling" student.

Via the feedback, the teacher should manage to make the student's errors explicit, and make them valuable as an asset in the learning process; in the meanwhile, the teacher has to sustain the students' motivation to learn and to mobilize all their meta-cognitive strategies in order to overcome the obstacles. Here the didactic mediation is substantial; the teacher must use several and differentiated didactic tools, give additional explanations, sustain the students' aloud reasoning (Weeden, Winter, Broadfoot, 2002; Bennet, 2010; Doabler et al., 2014).

Several researches about teachers' behaviour highlight that they agree about the fundamental role of FA for the quality of teaching, nevertheless – in their practice – they follow more often summative assessment praxis. Also, in spite of the fact that they use FA in their ongoing activities, they may use superficial tests, propose mechanical answers, or give a feedback that is too generic (Looney, 2011, p.10). In fact, they seem not to be prepared to interpret the evidence they have about their students' learning and often they attribute to external reasons the impossibility to implement FA (too many students in their classes, too large curricula to teach, organizational difficulties in their schools) (OECD, 2005).

The Importance of the Classroom Observation of Teachers' FA Practices to Improve Their Professionalism

The experience in the schools shows that FA is not a natural habit for the teachers and there is a need to improve the teachers' practices of FA.

In order to achieve this, it is essential to acquire a deep knowledge of what happens in class during assessment activities, so to pinpoint "good" and "bad" practices and to plan effective paths for teachers training and staff development.

To better understand the object of the detecting phase of the research, it can be useful make explicit what we mean with "good and bad practices" in FA.

We consider a "good" practice of formative assessment a practice which actually gives a feed-forward to the teacher and the students, providing an improvement of the teaching-learning processes in progress. For instance, in line with our theoretical framework, it is a good practice if the teacher, while presenting a task that will be formally evaluated, shares the criteria of assessments with the students. Moreover, we consider a "good" practice if, during the administration of a task, the teacher gives enough time so that every student can work on the test/task and monitors the good use of time and if, during the assessment, the teacher records facts and observations related to students' behaviour.

In our framework it is stressed the importance of peer and self-assessment as formative forms of assessment; so, for example, we consider a good practice when the teacher interacts with the peer and self-assessment process of the students.

Therefore, on the other hand, for us, these are examples of what we consider practices not suitable for a really formative assessment: teachers that don't share the aim and the object of the assessment, that don't keep care if the students actually understand the tasks and don't accept students' observations, that bound their feedback only to numerical marks.

Furthermore, teachers should assure a relaxing relation mood in classroom and don't generate anxiety and any situations of competition among student.

At last, we assume that the formative assessment must generate feedback on the teaching and learning processes, so it is important that teachers use also the summative results in order to create an occasion of formative assessment: in this way, for example, the use of errors found in summative assessments can become a tool for a "good" practice of formative assessment.

Thus the FAMT&L project is aimed to analyse specifically the assessment behaviour of the teachers and this is why having videos of the activity in class and analysing them is a very important tool.

The systematic observation of the behaviour of teachers in their classes dates back to work of Skinner and Bandura about teaching models and programmed instruction; it is from here that also the use of videos starts, above all with the strategy of *microteaching*, tuned up in 1963 by two researcher – K. Romney e D. Allen – at Stanford University (Allen, 1967).

Up to these days, many researches show that *microteaching* (Calvani et al., 2011) is quite effective and, more in general, so it is the observation of the teacher in class, with video analysis (of their own and other colleagues' practices) in order to promote teachers' changing of behaviours and to increase their professionalization (Rossi et al. 2015), and this also in the specific case of the teaching of mathematics (Casabianca et al., 2013; Walkowiak et al., 2014;). In particular, these strategies realize a tight link between theory and praxis, yield to a "view from outside" of the teacher with respect to themselves and to reconsidering what they did through a "reply" of their activity, via the recorded video sequences (Altet, Charlier, Paquay, & Perrenoud, 2006). All this:

- Allows a deeper reflection by the teachers on their own pratices and is a better answer to their needs of formation (Meyer, 2012; Ertmer, Conklin, & Lewandowski, 2002; Mottet, 1997);
- Guides any teacher to identify improvement strategies (much more than what the mere analysis of their students' results could do) (Kane et al. 2011).

This perspective is adopted by the researchers in the US (and Anglo-Saxon countries in general) (Guernsey & Ochshorn, 2011), and in particular by the major American professional associations (see the *New Teacher Project*; the *New America Foundation*, the *TeachStone*), but also by the research in Francophone countries about assessment and self-assessment of teachers (cf.. Laveault & Pasquay 2009; Paquay et al. 2010).

Thus also in the complex area of studies on FA, video-analysis strategies could give a valid contribute to act efficiently for the renovation in class assessment practices.

Research carried out by Kane et al. (2011) has attempted to explore the connections between the teaching practices of teachers and the student performances. It is precisely from these studies that the need for specific observational procedures emerges, in order to focus on the actions of the teachers in classroom, in particular on assessment practices. This is important both in the early phase of collecting information on students' learning, and in the specific phase in which the teacher is engaged in *formative feedback* to the student.

Observation in classroom aims to detect the assessment strategies used by the teachers during the teaching-learning process:

- How the teacher conveys tasks and criteria for the assessment to the students;
- How the teacher presents and hands out the assessment tests;
- How the teacher gathers information in class about students' learning;
- How the teacher corrects the valuation tests and the relative mistakes;
- How the teacher conveys a formative feedback to the students.

Via such observations it is possible to ponder about which are the good practices and which are not in FA; the analysis and the reflection with the teachers will help to achieve effective actions in teacher training.

Therefore, the training for teacher's in-service that was designed for the project FAMT&L uses the procedures of observation in the classroom as a tool to support the teacher professionalism, by sustaining the teachers in specific situations, in order to design and to improve their FA practices.

The FAMT&L Project and Its Phases

The project of research, which this chapter refers to, is the LLP Comenius Project "FAMT&L - Formative Assessment in Mathematics for Teaching and Learning" and it has as its main object the use of formative assessment in the process of teaching-learning and the role it assumes in particular didactic practices of mathematics teachers at the middle level of school (students aged from 11 to 16).

The five member partners involved in the project are the Alma Mater Studiorum University of Bologna in Italy, the University of Applied Sciences and Arts of Southern Switzerland, the University of Cergy-Pontoise in France, the University of Cyprus, and the Netherlands' Hogeschool Inholland.

Research is based on a descriptive design, with the use of observational studies and surveys in order to understand analytically math teachers' beliefs and practices and to detect training needs that require courses aimed at promoting a correct use of methodologies and tools to conduct correct formative assessment activities.

The phases of the work designed to achieve the objectives, consisted in:

- Survey on the beliefs and practices of students and teachers of mathematics about the evaluation of learning in the classroom;
- The design and the implementation of a web repository for teacher training, to support the adoption of a proper use of formative assessment in situations of teaching and learning of mathematics;
- The development of a training model for mathematics teachers;
- The subsequent testing and validation of the same.

Thus, the analysis started with the administration of questionnaires to teachers and students of each Partner's Country to gather information about beliefs and practices on assessment.

Furthermore, during the first phase (exploratory study), we conducted some case studies, with the help of video recording, to develop and try out an observational tool (a structured grid) to analyse assessment practices in the classroom.

At present, in the second phase, we are carrying out a systematic observation study on a larger sample of video sequences of teachers in the five Partner countries involved (Italy, Switzerland, France, and Holland).

A specific tool (a structured grid described in the next paragraph) has been defined for such analysis; by using indications from international literature and experiences of in-service training, we managed to gather many different indicators on good and bad practices for the formative assessment of mathematics teachers.

Via video-analysis, and the use of the observation grid, research pinpoints the habits of teachers about gathering information on the students' learning process, about correcting errors and using feedback to support learning.

With the videos collected about formative assessment situations, researcher will create a web-repository and design a teacher training program based on the use of such repository.

The project of the pilot training model started with the analysis of the results of a qualitative investigation about the beliefs and practices of mathematics teachers (in particular about the assessment in classroom), compared with the beliefs of their students.

In this work we will focus on the process of gathering and analysis of videos made in class, and then on the creation of a repository which will has to be able to include those and other didactic material to be used in training courses which will aim to promote FA in the practices of in service math teachers.

The videos collected for the web repository consist in recordings of real class situations, when mathematics teachers of the associated schools were performing assessment practices.

Examples of "interesting" situations that were considered are: the submission of a proof to students, the conduction of a written, oral or practical task, the correction of an assigned task (in group, individual or in pairs), the reflection on the mistakes that were made in a test; the teacher's formative feedback during the work on an individual exercise, etc.

From these "long" recordings a number of short video-sequences were obtained. The short sequences will be the main training tool for the platform implemented for the training pilot course and will be analysed through systematic observations, so as to detect the presence or absence of indicators of behaviour which we defined in detail.

The tool that was built for the analysis of the video-sequences constitute a coding scheme that allows a meta-dating of each sequence, and a more specific micro-analysis, which can be used for individual or group interpretations with trainee teachers.

In the next sections we will consider the operations of observing and analysing the videos we gathered by using a tool that was specifically created and tuned for this aim. This analysis allows archiving and metadata analysing of the micro-sequences and also led to a system of annotating the videos facilitating their storing in a web repository. These systematic processes should give an easy way to find specific materials in the repository, and also to integrate them into "pilot" training courses which should be a guide to promote a correct use of FA as a tool to improve the teaching of math.

In fact, this was the idea that guided the recording-analysis of the videos: to be able to use the analysed video-sequences as part of training courses for in service teachers. Such courses are aimed to the acquisition of specific skills in the use of formative assessment as an element that improves the quality of teaching.

In line with what emerges from the debate on teacher training, we can notice that the observation by the teachers of their own practices would allow them to change their behaviour by themselves and encourage processes of reconsideration on assessment and teaching.

A TOOL FOR OBSERVATION OF TEACHERS' ASSESSMENT PRACTICES AND VIDEO ANALYSIS

The correlation between the research on teachers' beliefs and the first phase of the observational research allowed to understand what kind of misconceptions the teachers have about formative assessment in the classroom.

What is shown is a common penchant towards the use of traditional practices of summative assessment and a difficulty in perceiving formative assessment as an useful tool to improve teaching and learning.

The difficulties in conceiving the efficacy of formative assessment have also been found while watching the video analysis of the first cases in consideration.

Many of the natural situations of mathematics teaching in the classroom, analysed through videos, point out an use of assessment with the following characteristics:

- It is specifically aimed at summative assessment, in order to give marks;
- It is not rigorous. The cases observed in natural environment show gaps in the "measuring" learning and an incorrect use of feedback to the student (labelling);
- It is poor at recording analytically the learning difficulties of each student.

The first results highlighted by the systematic observation of the videos allow us to understand the features of "bad" and "good" practices for formative assessment and to design specific interventions for teachers training.

Clearly, in order to get valuable information for our research, we had to build a tool for observation and analysis which could also be used to analyse the videos taped in class and for the archiving and categorizing of video sequences that can actually be used in future training courses.

Every video we got gets equipped with metadata which allow its categorizing and a sequent descriptive analysis (caring for correlations) that will help us define the profiles of assessment practices in the classroom.

Thus the grid we used has been structured with many levels. At the first level we find the data apt to "identify" the video files, so to allow a first archiving: 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.

At the next level we use categories which allow to get deeper in a qualitative analysis as much as we consider many variables which get into play in such a specific and complex process as assessment is.

From an environmental perspective (Bronfenbrenner, 1979), this observation grid allows us to gather different indicators on assessment practices of mathematics teachers, 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, etc.)
5. Phases of formative assessment (presentation of the assessment activity; gathering of information; correcting errors; feedback). (presentation of the assessment activity; gathering of information; correcting errors; feedback)

In the first category we consider information on the mathematics contents which are the teaching subject for each lesson/situation. With a view on the complexity of the teaching-learning process, clearly activities in this category cannot just be considered as contents in mathematical knowledge (*maths objects*), but we had to widen our horizon in order to take into account the abilities and skills that the students put into play in the learning *process*. Thus, we adopted a two-dimensional frame contents/capabilities, a scheme based on the OECD-Pisa approach (OECD-Pisa, 2013). For contents: Numbers; Spaces and shape; Uncertainty and data; Relations and functions. For 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 category (time) is useful in order to allocate where the (formative) assessment activity takes place in the longer time of the whole lesson. The setting (third) category considers the context of the formative assessment. This is needed since both categories, time and space/context (where we consider also the predisposition of the class group), are variables which can condition the didactic process and, if pedagogically planned and sufficiently suited to the specific learning situation, can have a very positive role in facilitating the apprehension.

The tools that the teachers use in their assessment activity are very important too (the fourth category is dedicated to them); in fact, in order to guarantee a correct and rigorous valuation, the teachers must use tools that are 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 our tool/grid because it gathers several kinds of behaviours and actions which will be considered as indicators to be observed in the different phases of the assessment procedure.

This grid has been revised in time and it is still subject 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.

This tool has been proved to be very useful and also well implemented. It has been integrated in the online repository which contains short analysed extracts from the videos, so it makes easy the analysis

itself and the metadata to insert in the videos, which can be found using single "words" of the grid as research and gathering criteria.

The repository (which will be better described in the next section) can at this time be accessed only by the researchers working with our project, because they are working to analyse videos and upload them on the present platform. As soon as the number of videos and other material will be adequate in order to be a valuable support for formative activities dedicated to teachers of several countries, the repository will become public.

Videos for Teacher Training on Assessment: Web Repository and E-Learning Platform

The grid described above has been set up specifically for micro-sequences (short videos) so to have a valuable tool for observation and analysis. To identify the observable indicators is a complex activity which has engaged all the partners in several attempts and working hypotheses and which produced a list of descriptions of situations which cannot be exhaustive since it is not possible to foresee all the meaningful possible situations that can happen in class. Hence there are blanks of the grid which have been left "open" for future comments and notes.

The University of Cergy-Pontoise (Paris) has been working video-analysis for years, hence their specific expertise and their hardware and software tools have been a very valuable support for our work. With their indications as a starting point, we carried out a research and 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).

Within the limits of our money resources and with the specific needs of our project, we realized a specific system for FAMT&L, which took its inspiration from the several software we have examined. Such system is a real repository 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 easily search and find the archived material using different criteria of searching. This way of organizing with metadata appears to be very functional also to gather quantitative data for statistics elaborations, to a macro-level, since it allows to find the total number of videos containing a particular value of some indicator.

On the other hand, this on line system permits also to get an easier visualization of the video sequences, of the categories used to label them and of the behaviour indicators that can be observed in the video itself.

The videos which have been gathered and analysed using this grid are systematically archived in the repository which has been designed for the web and implemented in order to be inserted in training programs specifically directed to in-service Math teachers (but it can also be used in pre-service training situations). We considered school grades corresponding to ages 10-16.

In order to allow the systematic use of the videos and of the other materials in pilot courses for the training of in-service teachers from the several countries in the project, we realized also a platform (Espace) which will permit to supply formative routes both on line and in person. At the beginning, such pilot courses will be tested in every country with in-service teachers and they will have a common model, to which the different materials (in different languages) will be adapted. Our perspective is though that those materials and courses could be adapted more specifically to different contexts and also be used in forming the future teachers.

In the learning environment (e-learning platform), different types of tools for teachers will be available: examples of learning contexts, video situations of mathematics teaching, assessment tools, training courses, etc.

All these educational materials can be used to promote a proper use of formative assessment in the teaching-learning situations; this platform will be the support for the training of mathematics teachers associated with the project.

The training program is based both on teaching general knowledge related to the field of 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, we think that it is the appropriate use of a correct FA methods and techniques is a key element to make the teaching of Mathematics more effective and innovative.

CONCLUSION: THE VIDEOS IN THE TEACHER TRAINING, BETWEEN THEORY AND PRACTICE

In the last years the teachers' professionalism is a subject of debate and international research (Perrenoud, 2002; Anderson, 2004; Darling-Hammond & Bransford, 2007; Koster & Dengerink, 2008; European Commission, 2002, 2003, 2005, 2012; OECD, 2005; UNESCO, 2005); and this research has been central in the matter of teacher 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, a good part of the scientific debate about teachers training activities seems to focus on a fundamental "crux" given by the relationship between theory and praxis, between knowledge and competences, i.e. by the research of how to form the teachers in such a way to get that the information they gain 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, meaning an alternation between distinct (but at the same time interrelated) steps in a specific learning process (Atlet, 2003) which are able to translate theoretic knowledge and methodology into an *action* and also, at the same time, reflection on the action itself, a reflection that, in turn, becomes new knowledge, and so forth. There are several different contributes to this debate, based on interdisciplinary studies (in Pedagogy, Psychology, in Neuroscience) as the ones of Evidence Based Learning[2], which offered a quite structured setting of knowledge about the most effective teaching methods, or as the most specific investigations aimed to point out the crucial factors in teaching behaviours in order to valuate and promote their efficacy, see the Gates Foundation's study (2013) or the work by international projects such as PISA, TIMMS, PIRLS (Pearson, 2012).

Many of those studies seem to validate the idea that a fundamental step for the professionalization of teachers is the identification of the most suitable ways to *conceptualize* their explicit practices in teaching (Rossi, 2014) by means of recursive processes, integrated and interdependent among them (Seidel and Stürmer, 2014), as are observation, comprehension, anticipation or prediction (Rivoltella, 2014) of what happens and can happen after a specific action.

From here several indications stem about the most effective methodologies to promote the co-presence of theory and praxis in the teachers training (both in-service or pre-service). Such are the practices of

laboratory activities and/or traineeship (Betti et al., 2014) and many techniques that can be based on the use of specific support tools, as, in particular, the videos.

Usually the training activities which are based on the use of videos are defined "*video education"*, an expression which covers an ample range of teaching experiences, starting with the first movies in the last century, to the use of television and analogue supports (VHS) and then to digital (CD/DVD) and telematic ones (PC and multimedia) to end up with the Internet and the so-called Web 2.0 (O'Reilly, 2005).

The presence of videos in training activities for teachers is more and more common, with several modalities in their use (Masats and 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 the teachers themselves, which is shared with the others, making it an occasion of comparison and debate with collegues or with a trainer (*video coaching*).

These modalities open several implications. The videos' content can be quite different: a teacher records her/him-self, use recording of colleagues or other experts, focus on specific didactic practices or behaviours, attitudes, interactions. Moreover, the videos 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). Also the length of the proposed videosequences can vary, from very short excerpts to longer and complex sequences.

Several studies, anyway, confirm the effectiveness of video-based interventions in the training of teachers: videos become a tool which is 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).

In the last years the didactic technique of *microteaching* has gained much credit; actually it is a technique that dates back to the experiences in the '60-'70's by K. Romney and D. Allen at Stanford University. Allen himself defines (1975) microteaching as a method 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 videorecording as main tool. This will allow the supervisors of the microteaching session to show to the trainees, via the analysis of the teaching sequence, which abilities will help them to solve the problem in their teaching practice end 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. This attention to 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 is what allows us to speak of the teachers as *reflective practitioners* (Schön, 2006; Damiano, 2007), and of a professional knowledge of their own (Calvani, Bonaiuti, & Andreocci, 2011).

Thus it is impossible not to see how effective the use of videos can be in the teachers training, but it is also important that this use take 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, 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 is aimed now at the elaboration of a pilot model of a course for mathematics teachers that can be followed in part as a distance course and in part in person. 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.

As we have already said, the idea that guided the recording-analysis of the videos was to be able to use the analysed video-sequences as part of training courses for in service teachers that can acquire specific skills in the use of formative assessment as an element that improves the quality of teaching.

In line with the debate on teacher training, the observation of teaching practices by themselves would allow changes in their behaviour and encourage processes of reconsideration on assessment and teaching.

In fact, the pilot course that will be developed will seek to use the video sequences analysed in order to promote critical thinking of teachers in training.

The model of the course will be tested and its efficiency verified with mall group 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.

In the repository will take place videos and other materials which could be used in several different activities:

- Activities of self-training, for expert teachers;
- More "formal" activities, where teachers are guided using analysed videoes to promote development of assessment skills;
- Activities in which the teachers may decide to be filmed to start a process of critical reflection on their teaching and evaluation methods so to be able to improve themselves.

Currently, the international research team is analysing the videos in the partner countries. The elements that are emerging are particularly interesting and underline the importance of observation in the classroom as a means for increasing the teacher professionalism.

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ENDNOTES

1 The chapter has been designed and shared in all its parts by all the five authors. In particular, The 1st and the 2nd § are by Giorgio Bolondi, the 3rd § and the 4th § by Ira Vannini, the 5th § by Federica Ferretti, the 6th, 7th, 8th § by Stefania Lovece.

2 The Evidence-based Learning (EBE) is an approach that, through comparative investigation methods (meta-analysis, systematic reviews, best evidence synthesis) tends to take stock of what is known about the effectiveness of teaching ("what works in what circumstances"). A critical synthesis of the results dell'EBE and convergences between these findings and some of the more relevant Instructional Design is presented by A. Calvani (2012) in "For evidence-based education. Theoretical analysis on international methodological effective teaching and inclusive "(Trento: Erickson).