



# 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 D3.1– Methodology** (methodological guide)

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<p>After the revision of the literature in the methodological domain, it has been defined a methodological guide, constructed and validated by the consortium allowing to collect and analyse data between various countries.</p>			

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## 1 Introduction WP3.1

The aims of this work package (WP3) are to make a focus on the practices of formative assessment of the mathematics' teachers; to gather information on training & learning needs of teachers; to collect and to analyse data on the formative assessment of the mathematics' teachers in the school contexts of the different partner countries involved.

The main goal is to develop objective observational measures of classroom instruction to serve as quantitative indicators of teaching practices in formative assessment. It involves from the methodological point of view to have the same methodology approach to collect the data, to use the same process to reduce video data, to exploit the data in the same way. That means to provide standardized procedures for using the camera and standardized procedures for analysing videos.

Tasks:

**Synthesis of the practices' analysis: interview, questionnaire and videos data in real situation of mathematics teaching;**

We organize a series of activities aimed on identifying examples of teaching and assessment practices (both positive and negative). Through video recording, these practices will be analysed according to the method of microanalysis and will be particularly useful as a training tool for teachers.

**Definition of common protocol of data collection;**

With the support of the research works TIMSS (<http://nces.ed.gov/timss/>), we will define a common protocol, including:

- methodology of data collection;
- methodology of data analysis;
- methodology of data selection for training.

**Definition of common protocol of data analysis;**

This methodology of analysis will be focused on the competences analysis to be able to join it into the training curricula.

**Selection and Indexation of data for construction of the web repository**

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First objective of the task consists in putting in parallel the speech of the interviews with the analysis of the actions in situations. The second objective is to have videos of situations to allow working on the reflexive action in life-long training. The third objective is to have materials for the training: contents, videos in situation and teachers' feedback analysis.

This document sets out the methodology (theoretical framework and methodological guides) that we will use in the project.

## 2 Theoretical framework of the methodology

### 2.1 History and representations of the uses of the videos in researches:

There are two contradictions LSHS (Arts, Humanities and Social Sciences): (1) distrust of the visual and (2) the explosion of technology and mass consumption of images, which have consequences:

- theoretical and methodological construction of the visual appeal;
- Data analysis methodology to implement;
- archiving, metadata

The researchers use different ways of video data, which you can find some examples below:

- Anthropology and Sociology: photo and documentary film;
  - Visual Cultural Studies: Visual Culture, receipt and consumption of public images, media;
- Mass Media studies;
- Women / Feminist Studies: Critical to the use of images of the female body (Cartwright)
  - Studies of social interaction in sociology / linguistics analysis of the organization of action, social practices, analysis of the uses of language located, Corpus audio from the 60s to today, video
- Study gestures (psychology, linguistics, etc.)
- Ergonomics, workplace studies; study of work situations
- Study of Sign Language

- Science education, for example: Observation and Research Centre on the teaching of mathematics and Michelet Schools Talence: COREM, TIMSS, CLASS

...

### 2.1.1 Historical References

- late nineteenth century, Haddon uses the movie to fix the population costume of Strait Toress



- use of films between the two WW: eg documentary film by Grierson (R3);
- visual anthropology explicitly begins with Mr. Mead and Bateson in the case of the study of Balinese culture: a film to exceed the limits of verbal language and to tell / show "etos the" ie "the intangible aspects of culture " ;
- interdisciplinary project, The natural history of an interview (1955):
  - o multi-disciplinary analysis of a film documenting the psychiatric consultation Bateson with Doris patient
  - o Participation Birdwhistell, which is developing a system of transcription and precise kinetic annotation video data

- Our primary data are the multitudinous details of vocal and bodily action recorded on this film. We call our treatment of such data a "natural history" because a minimum of theory guided the collection of the data. The cameraman inevitably made some selection in his shooting; and "Doris," the subject of the interview, was selected for study not only because she and her husband were willing to be studied in this way but also because this family suffered from interpersonal difficulties which had led them to seek special psychiatric aid.
- (McQuown, 1971, The Natural History of an Interview. University of Chicago Library Microfilm Collection of Manuscripts in Cultural Anthropology, series 15, Nos, 95-98)

- Pioneers of the Video: Kendon and Goodwin

- o Adam Kendon, pioneer in the study of gestures in a natural situation: movies from the 60s
- o Charles Goodwin is the global standard for multimodal interaction study: movies from the early 70s

### 2.1.2 Diversified uses

Non-exhaustive list of diverse uses of video in research in Humanities and Social Sciences:

- Dissemination of content: a viewer to read:

- o Video results as restoring means or used for communication;
- o Cutting by chapter or streaming;

- Elicitation of speech organized by researchers:

- o Video-elicitation (Krebs 1975 Balinese dance in a quasi-experimental perspective Asch 1980 trance in Bali, in a phenomenological perspective)



- o self-confrontation in ergonomics (Theureau), clinical psychology (Clot)
- Documentation of events, activities, social practices to an analytical reading:
  - o active viewing, selection of extracts, navigation in the video;
  - o video as material given corpus (Kendon Goodwin)
- Referential reading versus praxeological reading:
  - o referential reading emphasizes content, like video memorial and informational support;
  - o praxeological reading favors the organization of the action video as making available a phenomenon to be analysed in its temporality and dynamism (in game process). fundamental importance of time: both the overall time for action and time details of a movement, an adjustment to the other

In conclusion, first developed in the United States, research on teacher practice resulted in many works. They have long been enrolled in a paradigm of "process - product" by identifying variable categories (Durand, 1996; Anderson, 1983; Brophy, 1983; Doyle, 1983, 1986; Crahay, 1989) that influence student learning but reducing the study of the teaching process only to observable behavior of the teacher. These studies were designed to determine the "effectiveness" of education (Walberg & Fowler, 1991) and are still present today with a consideration of the "performance" of pupils (TIMSS, 1995 and 1999).

Secondly, researchers have developed the cognitive models "thinking of teachers" (Shalvelson 1981; Tochon 1993) who studied the cognitive nature of education: preparations, planning and decision making affecting practices.

Thirdly, the "ecological" models have rehabilitated the importance of the "situation" (Bronfendrenner, 1986) or the instructional. Finally in last decade, interactionist and

plural models (Robert, 1999; Rogalsky, 1999) have developed. They articulate several types of variables: the teacher, the learner and the "situation".

According to Beillerot (1998) "the practice, although they included the idea of the application, do not immediately return to how and gestures, but the methods to do. The practice is at once the rule action (technical, moral, religious) and the exercise or its implementation. This is the double dimension of the concept of practice that makes it valuable: on one hand, gestures, behaviors, languages; the other, through the rules, these are the objectives, strategies, ideologies which are invoked."

In order to treat teachers' practices, researchers have usually two methods: taking open notes (written notes, schemes, drawings) or the use of a coding grid, sometimes supplemented by copies of documents or a collection of objects created or used (Barron 2007). The problem is the number of constraints that occur during their use: the accuracy of the human eye, write speed when taking notes, the necessity of a long immersion in a population, reproducibility of data, elaboration of observation grids before observation and determination of categories.

The video is a great tool to try to appreciate the logic of action, as can be understand in the practices of the actor.

### **3 Methodology (Methodological guide)**

#### **3.1 Methods for recording video in the classroom**

Since the development of digital technologies and the extension of the video in the educational research field, different methodological practices to collect and to analyze data from video recordings have emerged.

##### **3.1.1 Video recording equipment in classroom settings**

The primary concern before starting to record practices on the classroom should be the choice of the video camera(s) and the positioning of the camera(s).

Before questioning the technical protocol, it is necessary to define, based on the theoretical framework, the types of data required. For example, access the contents of knowledge exchange between students need to have a quality recording, but whose? a student dyad, but then how to choose? how will they be representative of the entire class, an entire age? to have simultaneously the teacher, class and several pairs or groups of students? Each of the protocols we have just stated affect the sound acquisition device and therefore the effect of the record.

Recording a group of students need to have a strong and clear sound for each student in the group, so at least two devices are possible:

- An area microphone in the group center, on a table in height (10 to 15 cm) to avoid taking the sounds of objects against the table and good distances mouths. One micro manage, but also risks to not hear a student who moves too far or not actually in front of the microphone.
- A wireless microphone per student and thus we have a high quality sound reproduction for every student. Depending on the number of students in the group, it can be complicated to manage multiple frequencies, multiple batteries for the microphones, multiple receivers, a mixer to combine all sources on a single recording track ...

Regarding the teacher, two methods are possible:

- With a unidirectional microphone gun manipulated by an external operator to the teaching sequence. A sound of a high quality without battery problem, but someone outside the class that always drives a shotgun microphone in the direction of the teacher;
- With a wireless microphone, without the pressure of the shotgun microphone but with risks of tapping the microphone to have a battery concern, or a reception problem between the microphone and the receiver.

Then, as the analysis will focus on the articulation between the various resources: teacher talk, room ambience, issue of students in class, groups ... so it will be necessary to have a synchronization all sound sources.

Two devices are also possible:

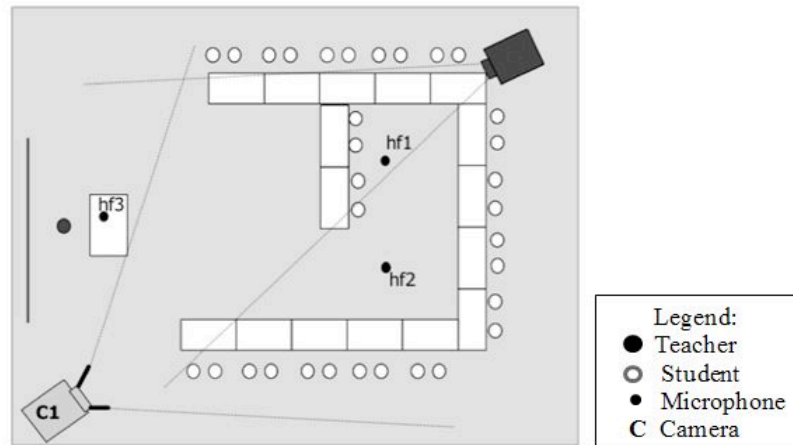
- Like in the movies, with a "clap" start, which is present on each sound recording and then allows it to declare clap as the zero time on what is called the time code.
- Merge all sources into a single source.

In the same perspective as the sound recording, the video recording situations must meet several requirements for researchers to exploit. First, the record must be very good, so the image should not be underexposed or overexposed, it must include all the information related to the sound capture. For example, it can be detrimental for analysis to have the sound and not the picture or vice versa. Several cameras are sometimes necessary, when data need to be the teacher, class and several groups of students.

Veillard (2013) analyze some research works in order to make the statement of video data collection methods. The characteristics of the situations studied (lessons in the classroom, lectures, practical work, interviews with teachers and / or students, or preparatory meetings between teachers) limit the variety of devices. He lists and describes just four types of video-recording devices developed by researchers to film teaching situations.

The first technical solution (for recording the entire class) supposes two cameras (a first camera equipped with a wide-angle lens on a tripod in a top class area, with a wide

static shot of the students and a second camera on a tripod in a corner in the back of the class with a static shot of the area around the table), a wireless lapel microphone worn by the teacher, one or more wireless lapel microphones worn by students to capture verbalizations in class (see the figure 1).

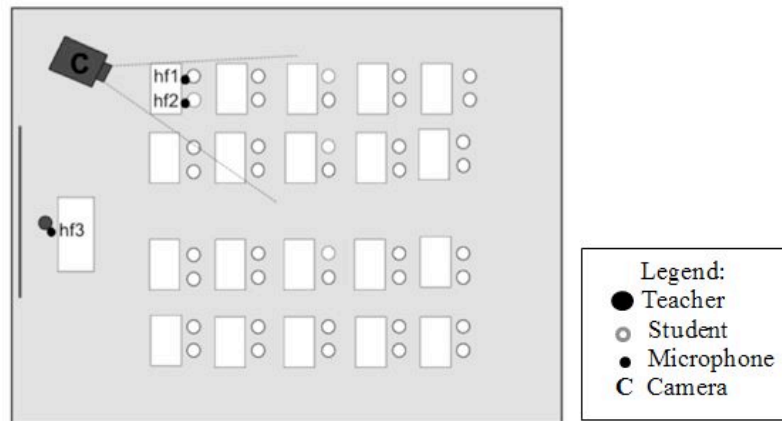


**Fig. 1: Video device for recording the whole class**

One version of this solution is presented in TIMSS project. The main idea in this project is to keep one static camera (on a tripod) and to use a second moving camera in two ways:

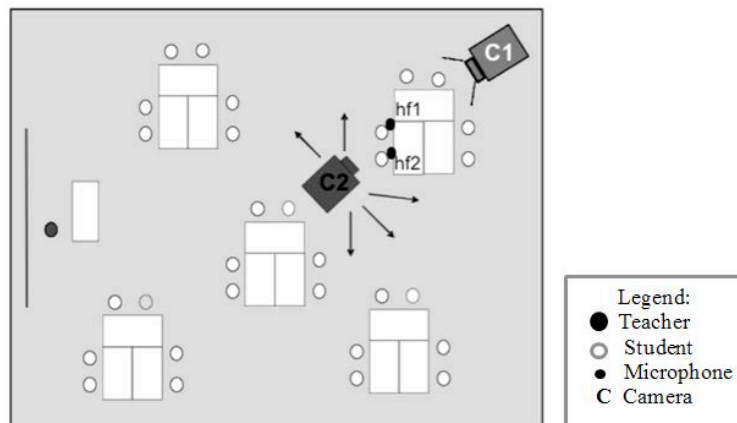
- On the tripod but by allowing framing changes during recording (for example: track the movements of the teacher, or some students)
- On the shoulder, which allow to follow certain actors or certain artifacts

A second solution is a binomial device. The equipment necessary in this case is composed by a camera on a tripod, with a static shot of the pair or small group of students studying with, in the background, depth of field on the immediate environment of the group; one or more wireless microphones to the students in this group; a wireless microphone on the teacher (see the figure 2).



**Fig. 2: Binomial video device**

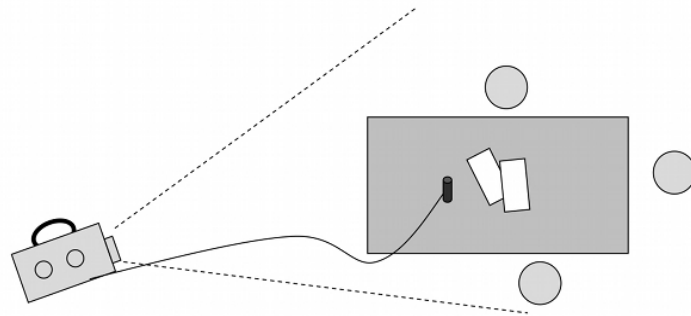
Another technical solution listed by Veillard (2013) is a mobile device for video recording adapted for kindergarten classes (as in French kindergarten classes) which are often divided into several areas where students are temporarily divided by type of activity. Because children are moving much from one to another zone, a camera up with wide static shot is usually not precise enough to capture what is happening in a given area. In this case, a second camera mobile, shoulder, will allow following the movements of children, including outside the class if the educational activity considered the leads to it (see figure 3).



**Fig. 3: Mobil video device**

The last video recording device described by Veillard (2013) is a technical solution adopted for meetings or interviews (see figure 4). The equipment is smaller and much

easier to dispose in the room. It is important to have a camera on a tripod, with a still shot of the players present at the table; a microphone wired room on the table or lapel microphones for actors. An additional camera can be installed above the vertical to film the materials used, handling and registration.



**Fig. 4: Video device for meeting/interviews**

To synthesize, there are four modes to use the camera (see table 1):

- Camera positioned on the tripod in static shot (no action on the camera which means no zoom, no movements) or in dynamic shoot (allowing zoom and movements in horizontal or vertical axis)
- Handheld camera (on the shoulder) without movements, zoom or with movements and zoom

	<b>Static shot</b>	<b>Dynamic shot</b>
<b>Camera on tripod</b>	<b>No action</b> <b>No movements</b>	<b>Zoom</b> <b>Movements on horizontal and vertical axis</b>
<b>Camera on shoulder</b>	<b>No movements</b> <b>No zoom</b>	<b>Movements</b> <b>Zoom</b>

**Table 1: Camera positions' modes**

Kilburn (2014) presents three methods for producing video recording within classroom settings depending on needs to capture or not more than one camera angle, to have or not the video available for immediate play-back, to have or not mobile equipment.

A single camera recording is necessary if we not wish to capture more than one camera angle. In this case, Kilburn (2014) advise to place at the back of the classroom a HD digital camera with a wide lens angle for learners or an optical zoom for teacher. The teacher is the primary “subject” for the video recording. The camera may be positioned in front of the classroom to record students. In this situation, the teacher will be left out of the shot.

Another alternative is to use a multi-camera recording for editing later (see also Veillard, 2013) or a live capture from multiple cameras.

Advances in digital video technology will allow new methodological approaches or developments. The wireless connectivity allows video to be transferred or ‘streamed’ to a nearby device using a wireless (‘Wi-Fi’) network connection, reducing for example the need for obtrusive wires to be trailed around the classroom when undertaking a live capture recording

Smartphones and tablets are not only able to record video, but can also take advantage of the same sorts of wireless network connectivity discussed above to transfer video to other devices. In fact, software developed for Apple devices even allows multi-camera recording from

Smartphones or tablets connected to each other wirelessly.

Wearable cameras, with ongoing improvements in the video quality, usability, and cost of ultra-compact wearable cameras, are bound to see more widespread use in the classroom

### **Advantages and disadvantages of camera’s types**

The camera on the shoulder is undoubtedly the one that allows the most opportunities: static shot throughout the registration or change of plan, zoom and camera movement, ability to remain static or change its position to better access certain events or follow the



actors. However, it is technically difficult to implement because it requires knowing precisely what we try to decide at any time to his position, framing and plan changes, relevance to zoom in on an item. In addition, it requires significant expertise in handling the camera for good quality images (stabilization of the camera, taking account of the light sources, anticipating noise conditions, etc.).

Hall (2007) is considering that “the job of a person operating a follow camera is to stay with the proxemic shape of the interacting group (i.e., bodies in relation to each other and things), ideally keeping everybody in that group within the visual frame as they move around. For example, a follow camera operator can attempt to have speaker and listeners in view as a speaker is making some point primarily with words. The reason for wanting to have the participants’ faces and bodies in view as much as is possible is that analysts will want to determine what people orient to in conversation (where gaze is allocated, how bodies are coordinated with media, etc.). But when the speaker begins to open a document to point out what he or she is talking about, or begins writing on a white board or sheet of paper, the follow camera operator can begin alternating between zooming in close to get the artifact-level details and zooming back out to get speakers and listeners. As a way to capture aspects of context that are (presumably) available to study participants, zooming in and out of the scene is preferable to panning across speakers and media” (Hall, 2007, p.9-10).

The camera on tripod is probably more secure, especially when it remains fixed during the entire recording. Registering the class in a static shot wide and makes the open video for further analysis by other researchers. It is however not without drawbacks, especially if a player leaves the field, or if important information for the analysis remain inconspicuous (eg enrollments table).

Anyway, as we have seen in the types presented above devices, usually researchers combine several of them, using multiple cameras. This allows multiple viewing angles on the same object and the combination of a large and fixed plan and a more local and mobile plan. This is essential when the researcher wants to be able to capture many local scenes that take place in parallel: for example, a discussion of the teacher with a

small group of students while other exchanges occur farther between, on the other students.

### **3.2 Data organization**

Leblanc, Ria and Veyrunes (2013) propose the construction of an interactively "electronic corpus" to organize data, heterogeneous and often very large, using a spreadsheet and hyperlinks to the direct opening of various documents. The digitization of video recordings on the computer can then be used to fix the collected data (such cuts that appear on the tapes), to hid parts of the image (blur faces or silhouettes if it lacks permissions to shoot some people), to mix different records (if two or more cameras are used, a record can be embedded in another) (Veillard and Coppé 2009), to move scenes or images.

### **3.3 Data Compression**

Because of their size, original video files cannot be kept in this form on computers (for reasons of space on device storage and facilities to handle them). Compression operations are needed to reduce this size. The multiplicity of formats (.avi file type, .mov, .wmw, etc.), of video encoders (Sorenson codec type, mpeg1, mpeg2, mpeg4), of audio (mpeg3, AAC, etc.) and of multiple adjustable parameters (flow rate, image size, etc.) do not facilitate this operation. A compromise must be found between the quality of picture and sound required for analysis, the smallest possible size of the video to allow manipulation and easier transfers.

Here are many free or payable video converting applications (for example: Adapter, Compressor, Episode, Handbrake, Media Converter, MPEG Streamclip, etc).

### **3.4 Methods of video-recordings analyze (Data Reduction)**

Veillard (2013) mention four methodological strategies used to perform the reduction of video data:

#### **3.4.1 Observation strategy and systematic coding video recordings**

TIMSS Video Science (Roth. et al. 2006) is an example of one type of methodology for the analysis of video recordings based primarily on coding categories. The objective of

this project is to compare teaching practices in different countries (5 different countries: United States, Australia, Czech Republic, Japan and the Netherlands) and study their effects on learning. To ensure the solidity of this device in all national contexts where it was to be used, the researchers first looked for a strong consensus among the participants of these countries which was given by the use of the same codes.

“Descriptions for each code were developed collaboratively as the group watched and discussed video examples together. Science Code Development Team members then independently applied the proposed definitions to a new lesson(s). Afterwards, the group compared their independent coding decisions and used differences in opinion as a strategy for clarifying the written definitions and for reviewing the effectiveness of the proposed codes in capturing the desired lesson feature. This process of independent review of lessons followed by group review and consensus building continued until 85 percent or higher inter-rater agreement was reached by the Science Code Development Team members or until a decision was made to drop, revise, or create new codes” (Roth et al., 2006,p. 7).

The data reduction is performed by reference to conceptual categories developed by researchers. It consists, for coders, in searching the information flows, certain defined events or objects, which are indicators of the presence or manifestation of these categories, definition of the work of these indices and their application link with categories have already been created by the designers of the encoding device. The following analysis is quantitative and operates through statistical processing (descriptive statistics and cross-tabulations mainly).

### **3.4.2 Crossing strategies for various types of descriptions**

Recently, many studies in comparative didactics (Schubauer-Leoni & al. 2007 ; Sensevy 2007 ; Sensevy et Mercier 2007 ; Tiberghien et al. 2007) postulate the interest of articulating several types of descriptions of the video recordings.

On example is the thesis of Marlot (2008), based on the theory of joint action in didactics. The author favors a work by contrasted case studies. Two class sessions are filmed and analyzed. Video recordings are complemented by primary data associated: questionnaires and interviews with two teachers, pre- and post-test questionnaires for

students. The data analysis process is operated in several successive stages which mobilize different modes of description video recordings under different registers or genres of discourse (narrative, synoptic, categorical).

### **3.4.3 Progressive refinement strategy assumptions**

The methodology introduced by Engle, Conant and Greeno (2007) to study the role of discourse in conceptual learning is based on a method of data reduction operated by so-called progressive refinement strategy assumptions. This methodology is characterized by an intense use of video recordings at all stages of the analysis.

It is successively used for:

- select relevant passages for the object of study related to the research mentioned by a specific discussion topic;
- characterize the phenomena by which manifests the object studied;
- transcribe more finely selected passages;
- code these passages with conceptual categories; search for factors explaining the phenomena highlighted and construct theoretical assumptions;
- test and refine these assumptions on other types of discussions.

This methodology needs an efficient indexation system.

“Searching for episodes of this topic was feasible because we had made content logs of the video-tapes in our collection.” (Jordan & al., 1995).

“A content- log is written by someone watching a tape with only minimal reiewing in order to provide a time-indexed list of topics being discussed.” (Engle & al., 2007).

### **3.4.4 A collaborative strategy researcher / actor observed**

As part of the action current, the theoretical point of view is to account for the asymmetrical relationship of an actor with his environment: he built his own world in the course of the action by selecting its environmental elements. The researcher is primarily interested in the pre-reflective consciousness, that is to say what makes a sign to the actor in the situation, his concerns, and that on which he focuses during the action. The data reduction work is strongly guided by the views on the action and is based on a methodological protocol where class video data is only an insufficient step to access this

object. The researcher must rebuild the own world of the actor which it is not direct accessible for him. The researcher does not operate alone data reduction but in cooperation with one or more actors.

## **4 Procedures and tools dedicated to the analysis**

### **4.1 Procedures**

The TIMSS video project is dominated by an explanatory logic: the aim is to highlight the relations of statistical correlations between on the one hand, class configurations, shapes and teaching content and secondly, learning opportunities, with efforts to develop a common and uniform coding system for all countries and to ensure the highest possible reproducibility of video encoding process, regardless of the cultural context.

Research conducted within the course of action is highly dominated by the understanding and focus on one or a few cases: it is about to focus on the perspective of the actor, on the meaning of the situation for him, on his own meanings.

Engel and colleagues highlight a real dialectic between comprehensive phases (search for video segments with a subject-specific discussion) and explanatory phases (analytical and comparative approach, using criteria and encodings, distribution speaking turns, quantification of overlapping, types and number of outdoor activities in the discussion).

Marlot uses the narrative register that refers to the idea of articulating interpretations and intentions of those events with more goals in the course of joint action. It also relies on a more explanatory language type analysis.

Some researchers follow the idea theorized by Lemke (2000) that the didactic or educational processes are located in complex systems that require multilevel analysis of temporal extension. This is of course the case of research that mobilizes type analysis scales as macro, meso, micro (Marlot, Tiberghien and Malkoun). Other research, however, do not distinguish between different levels of analysis (this is the case of Engle, as well as the TIMSS project).

### **4.2 Software**

Tools have been created to help with the annotation and analysis of video recordings. A number of programs have been recently developed in different human sciences disciplines in order to facilitate the analysis of video recordings.

**Clan** was developed by Leonid Spektor, from the University of Carnegie Mellonest, especially for linguistic researchers.

**Actogram Kronos** was created in ergonomics by Alain Kerguelen from the laboratory Work and Cognition at the University of Toulouse II (<http://www.actogram.net>)

**Advene** (Annotate Digital Video, Exchange on the Net) is software developed by the SILEX team (Supporting Interaction and Learning by Experience) LIRIS laboratory (Laboratory of Image Computing and Information Systems) from the University Claude Bernard Lyon I. It is specifically designed to annotate audiovisual documents and easily share hyper videos (<http://advene.org>).

**Videograph** was developed by Rolf Rimmel, IPN Kiel (Leibniz-Institut für die Pädagogik der Naturwissenschaften an der Universität Kiel) to facilitate analyzes conducted in the TIMSS video project (<http://www.ipn.uni-kiel.de/aktuell/videograph/enhtmStart.htm>)

**Transana** is being developed software research center on education from the University of Wisconsin-Madison (WCER) by David Woods. It is quite widely used in the field of education (<http://www.transana.org>)

**Anvil**, originally developed for gesture research in 2000, it is now being used in many research areas including human-computer interaction, linguistics, ethology, anthropology, psychotherapy, embodied agents, computer animation and oceanography (<http://www.anvil-software.org/>)

Other software: Observer XT, Coda...

## 5 Methodology

Before working in detail the methodology of acquisition, indexing and processing of data, we do a quick summary of our considerations in applied research and data.

We refer here to a concept of technology of praxis of the researcher:

- production chain;
- recordings situation;
- treatment of the corpus;
- data bank.

The production line includes several steps to implement the land to the data tape:

1. Analysis of the context: actors, rules and spatial organization;
2. Implementation of the Protocol taken video data: technical file, test, analysis and validation;
3. Data collection: audio, video, text and artifacts;
4. Archiving and description with metadata;
5. Transcription, annotation;
6. Anonymisation;
7. Inclusion in the database;
8. Qualitative and quantitative analysis.

The recording can be achieved in various ways:

- the researcher: Produced videos as data;
- by actors in the field: turned into video data;
- amateur videos.

In any case, we focus on the videos used as corpus for the study of activities, practices, language use, interaction situation. Consequently, the approach based on language, action and cognition gives importance to the context:

- Enter the speech, action, social practices "out there" where they occur (vs. under controlled conditions in the laboratory);



- Field practice, ethnography as preparation of the shooting;
  - Constraints on the context of the recording, the recording must comply (vs. the purposes of registration constrain action and filmed context).
  - Taking into account the importance of context leads to adapt the recording to action in the minimal disruption. The consequences on the way of filming are multiple:
    - preserve the temporality of the action;
    - preserve the participation format and mutual availability of participants;
    - maintain continuous access to relevant details of the action.

Such precautions lead to adopt a continuous sequence plane unlike filmed fragments which will be subsequently assembled by mounting.

Always hold an experiment logbook noting each recording what is implicit in the context such as: the reasons that have led to changes in the protocol, the atmosphere felt, perception of the situation ...

Corpus of the treatment involves three concepts:

- primary or first data;
- secondary data;
- alignment between the primary and secondary data.

Primary and secondary data Preamble methodological:

Diagram 1: processes involved in the implementation of a research plan

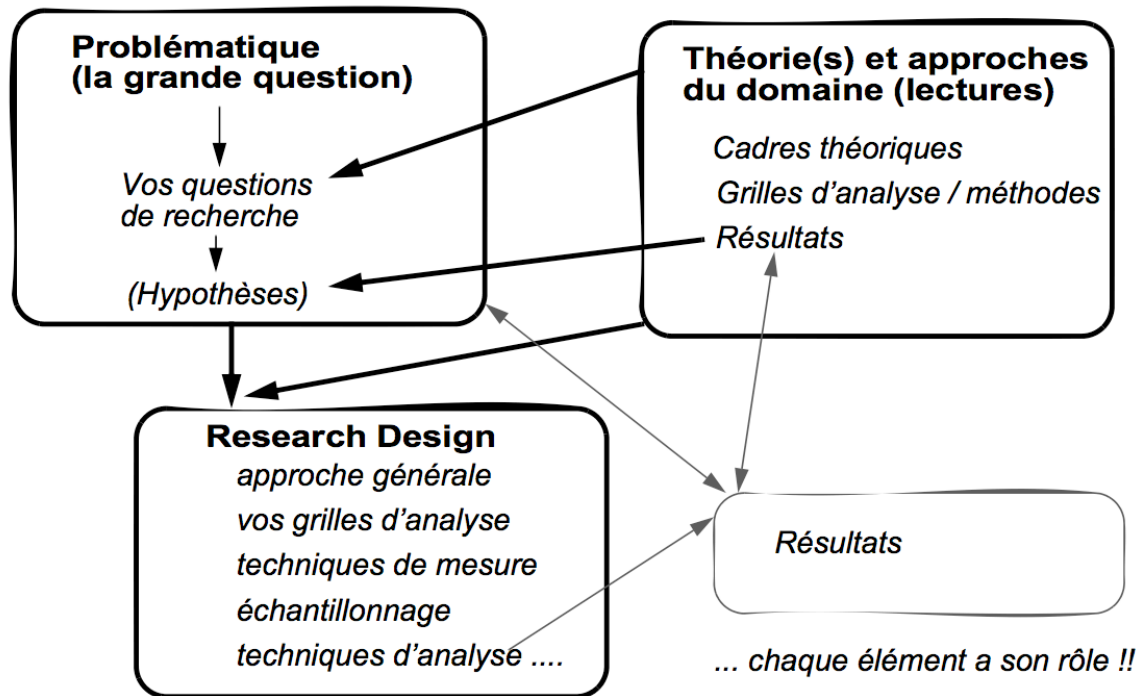
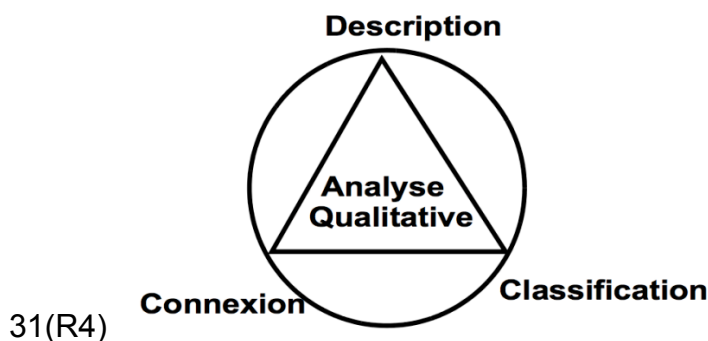


Diagram 2: the triangle: description - classification - connection by Dey (1993, page



Dey, I. (1993). *Qualitative Data Analysis*. Routledge, London

**Description:** collection and description of rich primary data

**Classification:** data reduction according to the coding principles (prior to analysis must be structured and during analysis must be restructured)

**The connection:** implementation report categories based on principles and techniques primary data

### 5.1.1 Primary data

Several types of primary data can be aggregated together to form the concept of corpus:

- video data in the same situation from different perspective: focus on the need to synchronize the time base;
- written productions: before, during and after registration;
- interviews conducted before and after, with or without the help of recording video data.

### 5.1.2 Secondary data

Secondary data are from the treatment of primary data and having annotations, transcripts and / or coding at different levels and any metadata for the video. Today there are a multitude of tools for annotations with different degrees of granularity. There are three major challenges:

1. standardization of transcription conventions or multimodal coding;
2. complex data representation;
3. editing worked data.

### 5.1.3 Classify, code and retrieve information

The analysis of traces of activity involves several steps:

- making primary data with all necessary precautions: never forget that taking data is unique, it does not start;
- the classification of primary data and counting;
  - o test the methodology;
  - o choice of the test sample;
  - o reproduction of the methodology: the tools of descriptive method with practical cards, implementation of the method by other researchers and measurement of the differences and similarities;
  - o modification and validation of the methodology for implementation of the harvest of the primary data;

- classification requires a first encoding descriptive level: date, day, time, conditions, content, duration, data component corpus, data naming nomenclature ...

- The second classification is to implement the scale of analysis: for example, two levels of analysis: a macro level: Description of the video as scripts for a period of 10 minutes and a micro level: from the order of the second. The rules of relations between the macro and the micro must be specified and are dependent on the theoretical framing.

- The event coding, concepts or actions is structured in several levels and may belong to a tree, for example:

- o code is a beacon, a short description of an action, an event, for example, he asks a question,

- o this code may belong to a category in the previous example: interrogative phase;

- o this category may belong to a grouping together several categories for the previous example: verbal interactions ...

- o in terms of the example, it is necessary to specify each condition to the application of different coding levels: what are the conditions to apply this tag to an action? begins when the tag when it closes? on what types of observable? what meaning?...

- o each tag, so it is possible to scale: in the previous case, the scale is binary: 0 or 1: it raises or it does not ask questions.

## 6 Methodological guide

Starting from the review of the literature presented in the “Theoretical framework of the methodology” section, we developed some guides for data collection and data analysis.

### 6.1 Data collect - Video guidelines

Each partner will produce some (10 or less) long videos in natural situations and in an organized situation of assessment in the classroom.

Each partner will extract from the long videos some short videos (involving episodes of assessment).

The short episodes should have a length of about 2-5 minutes.

Each country will upload onto the *Web Repository* platform:

- the long videos (the Mothers)
- a “x” number of short episodes (the little sons!)

### **EQUIPMENT**

The equipment needed to make videos in the classroom is:

- 1 camera (wide angle lens)
- 1 pedestal
- 1 reception for the microphone
- 1 power strip

It is necessary to decide when we’ve to start the recording.

### **COMPRESS VIDEO**

We will create a video in HD format (with the camera) and we need to compress it into an Mpeg4 file, in 2 formats:

- 320x240: format to be shared with the partners;

- 800x600: format for the video analysis.

To compress the video we could use the following program:

- *HandBrake*: for Mac, Windows and Linux

## WHAT TO DO WITH A VIDEO

After recording a video you need:

1. To archive it in HD format (the original format for the camera);
2. To compress it into an Mpeg4 file, in 2 formats:
  - a. 320x240
  - b. 800x600 (or 1024x600)
3. to give a name to the video.

For each video, make a **FOLDER**; each folder should contain:

1. The Video in HD;
2. The Video in Mpeg4 320x240;
3. The Video in MPeg4 800x600;
4. A Journal of the experimentation;
5. A file .spv created with iCODA .

## HOW TO CONVERT VIDEOS

To convert videos you can use HANDRAKE; it's a Multi-Platform software (Windows, Mac and Linux) and open source one. You can download the program from the following link

<https://handbrake.fr/>

To convert videos please follow the following instructions:

1- Click on “Source”, then on “Open file” and select the video file that you want to convert;

2- Choose the “Destination”: write the name you want to assign to the converted file, click on “Browser” and choose the folder where you want to store the video that HandBrake creates.

3- In “Output setting” – “Container” choose the option: **MP4 Files**

4- In “Output setting” – “Picture” – “Size” you can find a box naming “Width”. This box allows you to control the pixel resolution of the encoded video.

In the box “Width” You have to write:

- 320 if you want to convert your video with the resolution 320x240
- 800 if you want to convert your video with the resolution 800x600.

5- Click on “Start” to initiate the conversion of the video

The HandBrake guide is available at the following link:

<https://trac.handbrake.fr/wiki/HandBrakeGuide>

## **6.2 Data analysis**

### **6.2.1 Construction of the meta-name/keyword structure**

#### **Step 1- METADATATION OF THE LONG VIDEO:**

- Video's identification code;
- Country;
- Language;
- Type: audio/video (length, format);
- Creation date;
- Author (University);
- School level target;

- Number of pupils in classroom.

**Step 2- EXTRACT A NUMBER “x” OF THE SHORT VIDEOS ABOUT ASSESSMENT SITUATIONS:**

- SHORT video: “extract by long video n. (ID code) + CODE-NUMBER”

**6.2.2 Construction of the indexation grid of the activity in situation**

<b>1. MATHEMATICS CONTENTS</b>	<b>2.TIME OF ASSESSMENT</b>	<b>3.TOOLS/STRATEGIES</b>	<b>4.PHASES OF ASSESSMENT</b>
<p>1. describe the main content which was programmed</p> <p><b>a. CONTENTS</b></p> <ul style="list-style-type: none"> <li>- Numbers</li> <li>- Spaces and shape</li> <li>- Uncertainty and data</li> <li>- Relations and functions</li> </ul> <p><b>b. CAPABILITIES</b></p> <ul style="list-style-type: none"> <li>- Communication</li> <li>- Mathematizing</li> <li>- Representation</li> <li>- Reasoning and argumentation</li> <li>- Devising strategies for solving problems</li> <li>- Using symbolic, formal and technical language and operations</li> </ul>	<p>Say if the assessment period comes before, during or after the teaching moment:</p> <ol style="list-style-type: none"> <li>1. Ex ante</li> <li>2. In itinere</li> <li>3. Ex post</li> </ol>	<ol style="list-style-type: none"> <li>1. Use of objective tests:               <ol style="list-style-type: none"> <li>a) Multiple Choice</li> <li>b) True/False</li> <li>c) Correspondences</li> <li>d) Cloze</li> </ol> </li> <li>2. Use of open or semi formalized strategies of assessment               <ol style="list-style-type: none"> <li>a) Oral interrogation</li> <li>b) Semi-structured test (oral or written problems solutions, ...)</li> <li>c) Traditional trials (argumentative texts, ...)</li> <li>d) Peer-assessment</li> <li>e) Self-assessment</li> <li>f) Observation of student’s activity</li> <li>g) Discussion /questioning in the classroom</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Presentation of the tests/trials</li> <li>2. Administration of the tests/trials</li> <li>3. Recording data of student performances</li> <li>4. Giving back the results (Correction; Comments about the work; Explanation of the mistakes)</li> </ol>

MICRO-ANALYSIS: each Country conducts a micro-analysis of each short episode