





Formative Assessment in LDL: A Teacher-training Experiment

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Keywords: Mathematics Education, Long-Distance Teaching and Learning, Large-Scale Assessment, Formative Assessment.

Abstract: The pandemic crisis that overcame us last year still reflects on teacher education. This paper reports a teacher training experiment focused on the use of large-scale assessment materials in a formative perspective and in a laboratorial distance teaching setting. In 2020, during the period of long-distance learning, we implemented a long-distance teachers professional development program addressed to teachers of all school levels. This program was structured along 16 webinars that involved 2539 Italian teachers. At the beginning of the school year 2020/2021, a follow-up questionnaire was developed and implemented. One of the purposes of this questionnaire was to clarify how this experience impacted on teachers beliefs and practices. As a result, we find that our training program helped resilient teachers in outlining the potential of the technologies.

1 INTRODUCTION


This paper is positioned at the crossroad of three timely issues of Education, and Mathematics Education in particular. The first one, is an institutional-systemic one: how to foster the integration of the frameworks, the materials and the results of Large-Scale Assessments (LSA) into the classroom experience of the teachers. The second one, is a research perspective: Assessment is an access key to the teachers' beliefs and an helpful tool for the interpretation of teachers' choices and behaviours. The third one, is of course a topical issue: the ongoing pandemic fostered a forced and quick digitalization of almost all teaching-learning processes. Hence, not only teaching practices have been in many cases upset, but also theoretical constructs used to interpret, analyse, and discuss educational facts have been reconsidered. In this perspective, Formative Assessment (FA) is a key feature of assessment which is particular relevant.


The ongoing pandemic crisis that overtook us last year still reflects on teacher education. In Italy -the context of our study- there is traditionally a resilience in the use of technologies. The pandemic forced an acceleration of their use since most teachers were forced to use Long-distance learning (LDL) settings.


The fact that digital learning is reshaping education in many ways (Mulenga & Marbán, 2020a) has consequences and impacts students and teachers all over the world and it is a central issue in Mathematics Education research (Sintema, 2020; Mulenga & Marban, 2020b; Borba et al., 2016).


The global "lockdown" of educational institutions has caused in Italy, as elsewhere, discontinuities in internal assessments, the stop of institutional external assessments such the INVALSI Italian national tests, and a lively debate between teachers, experts and Institutions on the nature, purposes and possible forms of "genuine" assessment in a LDL situation⁵.

This paper reports a teacher training experiment conducted during the first lockdown period in Italy (march-june 2020). Schools were adopting Long-distance teaching and learning modalities, and also

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⁵ See f.i. the official notes of the Italian Ministry n.297, march 12th, and n.388, march, 17th.

teacher training activities (which in Italy are commonly activated as in-presence activities) must be activated in LDL. Hence, teachers were at the same time experimenting and implementing LDL with their pupils, and working in LDL as trained people. Both conditions were new for most of them, and this situation fostered their reflection and discussions on their own practices, in particular assessment practices.

During the period of distance learning, we implemented a free distance professional development teaching program addressed to teachers of all school levels. This program was structured in 16 webinars that involved 2539 Italian teachers.

Six of the webinars were structured by using questions implemented and applied in standardized assessments, to create “laboratorial” learning situations to be proposed in a LDL situation to students in a formative perspective. These learning situations were related to assessment tasks proposed in the National tests, hence solid data about students’ answers were available. Moreover, in some cases these items had been studied in scientific papers and the contribution given by these results to our knowledge of students’ difficulties had been highlighted.

At the beginning of the school year 2020/2021, a follow-up questionnaire was developed by a team composed by the trainers and experts from the Free University of Bozen-Bolzano who had been previously involved in the preparation, administration and analysis of the national tests. One of the purposes of this questionnaire was to clarify how it was possible to consolidate this experience with the processes of teacher education in the post-covid era. The questionnaire specifically investigated if and how the items from the standardized assessments presented during the webinars were known by teachers, if their results were known, and if this had an influence on their practices and beliefs from the perspective of formative assessment.

The questionnaire was administered to all teachers who attended the webinars and so far nearly 509 responses have been recorded.

The study is currently a work in progress and the first feedback allowed to clarify the reasons for which the activities proposed during the courses were (or were not) used by teachers. Our research hypothesis is that “assessment” is a crucial issue that helps the researchers by making “transparent” teachers’ behaviours and allows teachers’ attitudes and beliefs to emerge.

2 THEORETICAL FRAMEWORK

2.1 Formative Assessment

On the concept of formative assessment (term originally coined by M. Scriven in 1967) has developed over the years a fierce debate at international level, characterized by different positions, albeit with some consensus points. According to Domenici (2003), who introduced this construct in Italy, assessment is an essential part of the teaching/learning processes and is the act of conferring a value on something or someone. In the current educational context, the importance of learners’ acquisition of key competencies is increasingly central, therefore, assessment should ensure a quality education and training system in this direction. Within this perspective, assessment processes increasingly take on the connotation of a formative function. Certainly, formative assessment is not only part of teaching/learning processes, but often regulates their functioning as well. The central role of assessment with formative functionality is the identification, in an analytical manner, of the strengths and weaknesses of student learning. This allows teachers to draw insights and, if necessary, modify or supplement their teaching practices, giving feedback to students that in turn influences motivation and learning processes. These processes, in addition to encouraging the establishment of dialogues between students and teachers, often allow for actions that are functional to learning.

Indeed, an assessment can be defined as formative when it involves students in the analysis of their own mistakes and abilities in order to promote self-evaluation, peer evaluation and active participation in the teaching/learning process. It should also promote the learning of all students through differentiated instruction to ensure that each student has different rhythms and differentiated strategies within their personal learning process. A distinctive feature of formative assessment, therefore, is to provide information that is projected into the future of individual learners. In our context, several studies highlighted that despite this long tradition of research on the topic, formative assessment is neither entered in a systemic and stable way in teachers’ professional development activities, nor an aware classroom practice (Bolondi, Ferretti & Giberti, 2018).

2.2 Teacher Training Focused on the Use of Standardized Assessments

In the Italian National Indications (2012), assessment is entrusted to teachers, individual educational institutions and ministerial institutions. Among the latter, INVALSI (www.invalsi.it) is the research organization that, according to the legislation in force, carries out, among other tasks, periodic and systematic tests on students' knowledge and skills and on the overall quality of the educational offer, also in the context of lifelong learning (in particular, it manages the National Assessment System SNV). There is a strong endorsement in the literature regarding the close connection that there should be between standardized assessments and each country's National Indications (Meckes, 2007; Looney, 2011). In particular, the Italian SNV standardized assessments answer this need. Nevertheless, these tests should increasingly become tools in the hands of teachers that can incorporate and, in some way, "enhance" each teacher's own assessment expertise (Di Martino & Baccaglioni Frank, 2017). Moreover, results from LSA can be very useful for clarifying the extent of a didactic phenomenon (Bolondi & Ferretti, 2021). Using the results of standardized tests appropriately and efficiently is fundamental in any educational system. This may help for instance in clarifying in a given particular context the specific phenomenology of known didactic problems (Bolondi, Ferretti and Giberti, 2018).

This is an institutional issue, of course, but it is also an important individual issue for each teacher. This integration of LSA tools (frameworks, results, released items, studies...) into classroom practice cannot be achieved without a specific attention to the teacher's professional development.

2.3 Standardized Assessments from a Formative Perspective

First of all, standardized assessments can provide teachers with tools and benchmarks for their diagnostic assessment. As Harlen (2000) suggests, diagnostic assessment involves discovering what students have and have not achieved, as well as their strengths and weaknesses related to different content areas. Through this analysis of students' abilities and capabilities, it is possible to implement educational pathways and define appropriate standards (teaching and assessment methods) in accordance with learners' actual needs (Gipps, 1994; Qassim, 2008). Diagnostic assessment requires a basis that is as objective and shared as possible, in order to understand what is

really being assessed and what information will actually be returned; in this direction, standardized assessments can provide significant help.

Each teacher has his or her own epistemology and implicit philosophy (Speranza, 1997) regarding the teaching/learning process and this applies to assessment as well. The implicit framework has a deep impact on both the definition of the actual implemented curriculum and the choice of teaching tools and practices. Thus, standardized assessments can help in making explicit and gaining awareness about these implicit factors; matching one's beliefs to explicit frames of reference and comparing one's student outcomes to different benchmarks is a crucial step in a teacher's professional development. Finally, discussions among colleagues about systemic and their own students' outcomes are critical in the process of making explicit their own implicit philosophies (Bolondi, Ferretti & Spagnuolo, 2014).

Furthermore, standardized assessments can help in understanding the demands of the National Education Documents, as they provide examples of standard attainment. This requires creating a close link between the goals and objectives of the National Indications and the planning and organization of teaching; it also requires work on teaching materials (e.g., textbooks), which are still, in Italy, the main source from which teachers take inspiration for classroom and homework activities. Moreover, standardized tests, together with other teaching practices, such as questions and classroom discussions, can help to understand not only the final product, but also the process of learning. Within our courses, we have therefore tried to build learning situations from standardized assessment tests.

2.4 The "Laboratory of Mathematics" in the Italian School Tradition

A key element of the program was the idea of "Laboratory of Mathematics". Mathematics is not learned by contemplation. The fact that the active involvement of the learner is an essential component of any healthy teaching-learning process is taken for granted today, whatever the body of knowledge with which one is dealing. In mathematics, however, this is also closely related to the nature of the discipline itself. This idea is deeply-rooted in Italian tradition, since the pioneering work of Emma Castelnuovo (Castelnuovo, 1963). She formulated the iconic idea that it is the whole classroom that must be a laboratory of mathematics: in it must be available materials for experimentation and construction.

The laboratory does not need to have its own dedicated physical space: however, it does need to have its own well-defined time, its own physiognomy that distinguishes it from normal school hours. Whatever form it takes, it must succeed in involving the students: necessary condition for this to happen is that the teachers are the first to challenge themselves, investing their energies, their inventiveness, and even their own faces. So, Castelnovo's approach is suitable also for LDL.

In the period of pandemic and distance learning, many teachers abandoned laboratory teaching because they could not design it. The course we structured was designed to provide tools to do laboratory teaching and maintain formative assessment activities even at a distance.

What are the tools that a teacher has available today to help his or her students do mathematics? The word "laboratory" seems to promise to change and perhaps break the chains of tacit or explicit contracts that within the walls of schools bind students, teachers, institutions, families... We set some characteristics of the way to carry out a mathematics laboratory. This will allow for further clarification on what topics, what tools, and what methodologies a teacher can conduct a laboratory in the particular context in which he or she is working.

We specify below some of the fundamental characteristics of the mathematics laboratory that we used for structuring our proposal (Bolondi, 2006).

L1) In a laboratory there are things to understand: data, facts, situations to observe, study, reproduce, and arrange. Students enter the lab because they want to understand something (personal involvement);

L2) In a laboratory students start from the problem, not from its solution. This is a particularly crucial point for us (as mathematicians). The final point of any mathematical research is the construction of a formal theory, possibly general, crystalline and essential in its logical-deductive organization, of which all the concrete situations we encounter are only particular cases, but this is the point of arrival of the work of mathematicians, of work in mathematics, and can never be the starting point for our students. When you learn, when you discover, when you try to understand, there is also work to be done that cannot be delegated to others (epistemological involvement);

L3) It is not possible to know a priori what students will need to understand the proposed situation (inquiry approach);

L4) In a laboratory, work is never only individual. Collaboration between different people can take place on many levels and in many forms, but

this can only happen by working on concrete problems, which involve the students and the teacher as real challenges (social involvement);

L5) In laboratory work there is no clear dividing line between theory and practice: every observation made in the field, every concrete situation can become the starting point for a theoretical construction.

L6) In the laboratory, all that students can contribute to make sense, even mistakes, and contributes to building the meaning of the body of knowledge within which you work.

L7) In order to solve the problems posed by concrete laboratory situations, intuition is combined with rigor, imagination with method, inventiveness with craftsmanship. This is particularly important for mathematics: mathematical reasoning is so formative, so important, so "beautiful" because it is not abstract logic from symbolic calculation software.

Mathematical activity also requires a capacity for visualization that must be developed with the appropriate tools, and the laboratory is a place to do this.

3 METHODOLOGY

We designed a teacher training program focused on the functional use of standardized assessments within each teacher's personal Mathematics laboratory practices in the LDL setting, followed by a questionnaire. The trainers had a previous experience (since 2010) of presential programs with the same background and purposes. The design of the program had been improved since then through repeated implementations and validation of the original project. The challenge was to transform these experiences into a LDL program, designed to support LDL activities with the classrooms.

This course, delivered via webinar, was structured into meetings that would highlight the following aspects:

- Theoretical references to formative assessment, to large-scale assessment, and to their relationships and interfaces;
- Analysis of items from Italian large-scale assessments and critical look to their relation with the national curricula;
- Analysis of assessment situations and design/implementation of laboratorial teaching activities to be performed during the lockdown period through the use of technologies (videos, platforms, padlets,...)

- Emphasis on the fact that the results of the standardized assessment, which highlight macro-phenomena often already studied in the literature and referred to in the tools available to teachers, allows teachers to intervene punctually, during the teaching action, on the critical aspects of the learning process in a formative way.

The training experience we carried out was centred on laboratory activities designed starting from items of large-scale assessment test, whose results could help the teachers in a formative assessment perspective. The topic was not standardized tests, but we aimed to propose teaching materials designed from standardized tests to do laboratory activities. These activities were developed vertically, so that teachers of all school levels could use them.

In the presential modality, the training was carried out with small groups of teachers (20-30), who had the opportunity to take part in activities and discuss them. Digitization made it possible to reach many more teachers at the same time, but at distance the possibility of interaction during the training sessions was almost entirely limited to chat because of the high number of participating teachers (an average of 1000 teachers per webinar). To overcome the lack of discussion, we fostered the discussion in the chats during the webinars and we implemented a final questionnaire that was designed to give teachers the opportunity to express their reflections by simulating what was happening in the presence. The purpose of the questionnaire was also to validate this teacher experiment.

The design of the questionnaire intended to make explicit how standardized assessments impact on teacher expertise and how standardized assessments impact on teacher assessment.

Therefore, there were several sections inside the questionnaire, each with a specific purpose:

- **Section 1:** designed to investigate whether teachers were familiar with the questions from the standardized assessments used by trainers during the webinars;
- **Section 2:** designed to investigate whether teachers knew the results of the questions from the standardized assessments used by the trainers during the webinars;
- **Section 3:** designed to investigate whether teachers recognized the evidence of macro-phenomena highlighted by the results of the standardized assessments;

- **Section 4:** aimed at investigating whether teachers had used some of the suggested activities in the classroom to explicit the presence of some of the misconceptions highlighted by the results of the standardized tests;
- **Section 5:** aimed at investigating whether the reflections that emerged during the webinars had changed some of the teachers' practices or some of the ideas related to assessment.

The questionnaire consists of 19 closed-ended questions.

The questionnaire was sent to all the teachers who took part in the webinars and we received responses from 509 teachers. In the chat recorded some hundreds of comments and remarks were collected.

4 DISCUSSION AND FIRST RESULTS

The new context triggered by the covid-19 pandemic has put us in a very special situation. The situation of distance learning is necessarily on two levels: teachers with students and trainers with in-service teachers. As a matter of fact, the majority of the teachers involved in this teaching training experiment had never looked for distance learning before this event.

In the following we comment on two types of results collected: the elements that emerged in chat and the results of the questionnaire.

This experience challenged some beliefs that teachers had about distance learning and that also emerged from some comments written in chat by teachers during the webinars.

One teacher writes "*I was sure that I couldn't do laboratory activities at distance and now I changed my mind!*".

Many teachers, during the period of distance learning, started working in the new situation by simply reproducing in front of a camera their classroom traditional lectures, because they were convinced they could not implement laboratory activities. The course gave them the opportunity to see that they could do laboratory activities and with which tools.

The chat comments reveal another of the concerns of the teachers during this time period: assessment. A common teachers' initial belief was the idea that assessment must be, at the end of the story, nothing else than a score. Hence "formative assessment" was just a formal expression in official documents, with a

weak relation with “real” assessment (which is, in their idea, summative assessment). This is reported in several comments, including the following: *“How can we assess our students without limiting ourselves to formative assessment? I am currently putting positive or negative annotations, but never assessments because I think it is impossible to assess objectively at a distance.”* We remark that summative assessment, in Italian schools, is mainly performed through oral questions and written individual tasks. Teachers' worries on the topic of assessment were many, since these modalities were actually difficult to be implemented in the LDL situation.

To the questionnaire answered 351 primary teachers (from grade 1 to 5), 106 middle school teachers (from grade 6 to 8) and 52 high school teachers (from grade 9 to 13).

Despite teachers' initial difficulties, the course had a strong impact on the teacher's implementation of distance learning. This became evident thanks to the answers given by the teachers to some of the questions in the questionnaire.

One question asked, “Before attending our webinars, had you ever used video to implement classroom activities?”

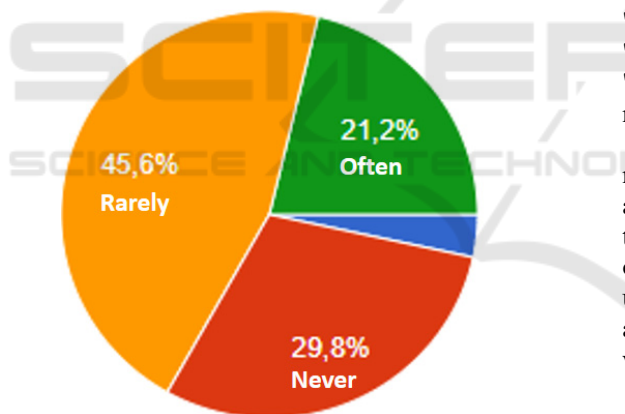


Figure 1: Results of the question “Before attending our webinars, had you ever used video to implement classroom activities?”.

There were 3.4% (17 teachers) who responded "Systematically," 21.2% (108 teachers) who responded "Often," 45.6% (232 teachers) who responded "Rarely", and 29.8% (152 teachers) who responded "Never".

All respondents who answered "Systematically" were found to be secondary school teachers (from grade 6 to grade 13). In fact, all of the primary teachers and most of the secondary teachers subscribed to the webinars had not previously used

videos or other such materials before the training course.

Another important question was the following: “When you return completely in presence do you plan to continue using the materials offered during the webinars or elements of this experience?”

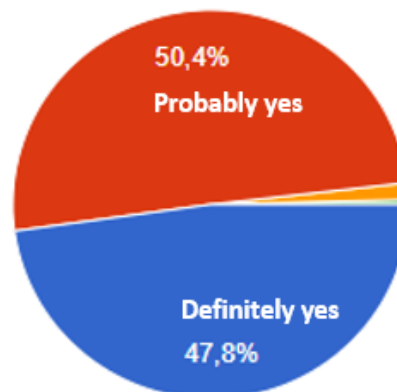


Figure 2: Results of the question “When you return completely in presence do you plan to continue using the materials offered during the webinars or elements of this experience?”.

There were 47.8% (243 teachers) who answered "Definitely yes", 50.4% (257 teachers) who answered "Probably yes", 1.4% (7 teachers) who answered "Probably not", and none who answered "Definitely not" (0.4% -2 teachers- choose the answer “Other”).

One of the conclusions is that these teachers did not use materials of this type before the course, while after the course they say that even when they return to in presence they will probably or definitely use and continue to use these materials. So they think that the use of these materials can be valid also in presence and does not replace by the teaching in presence, which gives other things.

One of the aspects highlighted during the webinars was the development of synchronous and a-synchronous activities. In presence a teacher can only do activities in synchronous, while -with these materials developed in a-synchronous- the activity can continue also outside the classroom. This aspect is one of those highlighted as a positive of distance learning.

5 CONCLUSIONS

We have shown how the theme of turning large-scale assessment into a tool for doing formative assessment is significant. We also made explicit what themes were involved during the teacher training webinars.

A first analysis of the answers given by teachers to the questionnaire allows us to claim that the activities presented during the webinars can actually offer multiple opportunities to work at distance with students and with the class as a whole.

The course was designed to provide tools for implementing laboratories in the sense outlined in our framework and to support formative assessment (even at a distance). In fact, our focus on laboratory activities was designed to maintain formative assessment activities even at a distance.

The project has been developed in an emergency situation and in a context where the use of technology for distance learning was very limited in Italy and the assessment basically summative in practice. Working alongside teachers to provide tools and materials with a theoretical background in mathematics didactics research in order to carry out distance learning of a laboratory type (always in an emergency) with particular attention to the dynamics of formative assessment that could be applied in this situation has allowed teachers to understand that

- It is possible to do laboratory activities at a distance;
- Assessment is not only summative, indeed formative assessment is fundamental in the teaching-learning process;
- Specific training is necessary to use these materials properly;
- Large-scale standardized assessments can help us to highlight macro-phenomena that might be reflected in every classrooms.

ACKNOWLEDGEMENTS

We thank all the trainers and the tutor who participated in the program for their helpful suggestions and the work done for collecting and commenting the chats.

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