

Article

# Assessment Practices and Beliefs: Teachers' Perspectives on Assessment during Long Distance Learning

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**Abstract:** The COVID-19 crisis has strongly affected the school system. In Italy, at-distance forms of didactics have been activated, changing the physiognomy of schools in terms of social interaction, practices and the identity of the individuals. In this paper, we address the issue of how teachers are facing the crisis: our focus is on assessment, as a key variable catalyzing personal history; beliefs; the interface between students; teachers and the school system. We study teachers' beliefs as part of their identities and assessment as a fundamental variable of beliefs. A qualitative content analysis of the open-ended answers to an online questionnaire is carried out to understand the main characteristics associated with assessment by teachers and the obstacles to overcome in the context of long distance learning (LDL). The data show that teachers did not identify valid assessment methods for LDL during the lockdown, especially due to the lack of control over the students. A misconception emerges concerning the definition of formative assessment together with a new awareness of the possibilities offered by digital technologies regarding the individualization of didactics. This study helps to understand which teachers' beliefs are related to assessment are and how they are shaped.

**Keywords:** teacher identity; teachers' beliefs; long distance learning; formative assessment



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## 1. Introduction

The 2020 COVID-19 pandemic crisis has hit our technologically globalized world hard. Education has been strongly affected by the COVID-19 crisis. The emergency caused by COVID-19 has highlighted some the strengths and weaknesses of educational systems. The pandemic has affected all countries, but in different manners and with different nuances across the many educational systems. According to available data, for the first time in history more than 1.5 billion girls and boys all over the world are experiencing enforced interruption of their school life [1]. In Italy, at the beginning of the pandemic with an official ordinance dated 25 February 2020, the official recommendations of the MIUR (the central authority) suggested activating at-distance forms of didactics (LDL, Long Distance Learning). Schools, teachers, pupils and parents faced this switch with a great variety of attitudes, tools, resources and motivations.

Overnight, schools and universities changed their physiognomy in terms of social interaction, practices and the identity of the individuals. Such a change was possible thanks to the overwhelming development of digital technologies that have occurred in the past 20 years.

It is difficult to foresee in the forthcoming months a "return to normality", which is difficult to configure in terms of time and methods. Moreover, the emerging strengths and weaknesses of educational systems can be an opportunity to problematize the idea of normality itself. It is necessary to give impetus to a broad discussion and reflection;

it is necessary to rethink teaching and, inevitably, how and in what way this period of distance learning will influence future practices. It is indispensable to thoroughly analyze the experience of LDL in order to draw ideas for recovery and future developments.

The role of technology is a cutting-edge research topic in education and in particular in mathematics education. The authors of [2] offer a broad and organized overview of the main research trends in digital technologies used in mathematics education. The authors of [3] present a research survey on the use of digital technologies at the preuniversity school level. Overall, it emerges strongly and transversely that an educational system enriched by the presence of digital technologies undergoes profound changes involving fundamental and load-bearing elements, which span from instrumental to strategic, from personal to social and from pragmatic to affective. Despite being published prior to the arrival of the pandemic, the reflection in [2] suitably highlights how digital technologies trigger an in-depth deconstruction at the basis of the mathematics classroom, enabling new forms of classrooms and new ways of working, triggering new sociocultural dynamics:

“Currently it seems clear that digital technology is “deconstructing” the notion of the classroom. [...] Mobile technology, PLNs, digital learning objects and other artifacts are “stretching” the classroom, transforming the classroom to the extent that it can hardly be recognized as such. [...] In this scenario, the regular classroom no longer serves as locus for education. Couches, chairs, tables at students’ house, café and Lan Houses are the new classrooms. Flipped classrooms change the notion of what is in and outside of the classroom and also change the roles of students and teachers” [2] (pp. 605–606; PLN stands for Personal Learning Networks).

Profiting from the affordances of digital technologies, despite the severe lockdown imposed by the Italian government, schools and universities have been able to overcome the physical distance imposed on teachers and students and guarantee—with differences across the country depending on socioeconomic factors—the usual teaching and learning practices. The enforced introduction of digital technologies changed the sociocultural space in which educational activities take place: more precisely, during the lockdown this space was marked by the complete exclusion of any form of physical interaction [4].

At the beginning of the lockdown, the situation in Italy, despite many central and local projects enhancing the use of technologies [5,6], was extremely varied, almost completely depending on the free choices of the teachers (and of course on the technological equipment of the schools, of the teachers themselves and of the students).

We can say, in line with [7–9], that this extreme condition appears as a special occasion to investigate the present situation of mathematics teaching and learning. The abrupt change and the furthest edges to which educational systems have been pushed allows us to outline some of the features of mathematical activities. Assessment practices deserve special attention because they inform how teachers think about the educational relationship and their work.

The aim of this article is to analyze how teachers responded to the pandemic crisis by adapting to LDL. Assessment is our window for this problem. It is a key issue that catalyzes individuals’ personal history, their beliefs and the interface between teachers, pupils and the school system. From this perspective we explore how teachers are facing the COVID-19 crisis in the educational context: how they define assessment in this context, what difficulties and new practices they relate to it and what factors in this situation act more strongly on students’ “evaluation”.

In Section 2, we develop our theoretical framework and research questions; in Section 3, we describe our methodological setting; in Sections 4 and 5, we present our results and our discussion and in Section 6, we draw some conclusions and offer possible developments of the present study.

## 2. Theoretical Framework

Any adaptation process determines a modification of individual and social activity in an adjustment to cultural surroundings. Such a change can often be unconscious. Thus, in order to frame and analyze the teachers' adaptation during the enforced LDL, we follow a twofold analysis. On the one hand, at the individual level, we choose to consider the dimension of teachers' identities and, in particular, teachers' beliefs as fundamental parts of their identities. On the other hand, at the systemic level, we focus on the assessment process. Indeed, assessment assumes a crucial role in the Italian educational system, hence also in shaping teachers' beliefs. We present some theoretical tools regarding teachers' beliefs and identity and formative assessment that we will use in the analysis of our data.

### 2.1. Teachers' Beliefs and Identity

Mathematics education research has traditionally looked at a teacher's identity as a system of beliefs. Teachers' beliefs have become a focus of research in mathematics education on the agreed assumption [10–15] that beliefs affect school practices and behaviors.

Seminal papers in the field include Pajares [16] and Thompson [17,18]. The two researchers show two different approaches to beliefs. Pajares (p. 316, [16]) looks at beliefs from a broader point of view, speaking of *educational beliefs about*. On the other hand, Thompson [17,18] and Sullivan and Mousley [19] refer directly to teachers' beliefs about mathematics and their conceptions about the nature and the learning of mathematics. Frykholm [20], Beswick [21] and Leatham [22] focus on the inconsistency between beliefs and practices in teachers' behavior.

In a more recent study, Skott [23] highlights the importance of context as crucial to the study of the relation between practices and beliefs. In other words, beliefs are no longer seen as explanatory principles for a teacher's practice. The study takes into account the complex network of factors, which define the teachers' social contexts in their decision making and behavior. The idea of *system thinking*, widely discussed in [24], is based on the assumption that the concept of belief can be better understood in the relation to other constructs, such as attitude, affect and values, where the different parts are not separable from each other and are situated in a specific context within any person or group. In the most recent years, research has moved to a more complex framework to define classroom practice in its dynamic character. The issue of defining beliefs has been rephrased, and beliefs are now seen as part of a larger set of constructs regarding teacher identity and classroom interaction, where teachers are "sensible systems that act in a coherent way" [25] (p. 24). Hence, we can speak of *identity* as a net. More precisely, the professional identity of a mathematics teacher can be defined as the net of beliefs, values and commitments an individual holds toward being a teacher (as distinct from another professional) and being a particular type of teacher, such as a mathematics teacher. This is a complex and fluid construct studied with different techniques and from different points of view, with emerging components ranging from self-image to motivation, commitment, self-efficacy, task perception and job satisfaction [26–30].

Beliefs, values and commitments associated to assessment and classroom feedback are hence a fundamental part of a teacher's identity, and they may also be considered a fundamental part of a student's identity as a mathematics student [31,32]. Assessment informs professional identity because both observed practices and declared statements about assessment (even if not coherent, see [33]) unveil crucial information about teachers' subjectivity [34,35].

For the purpose of our study, we would like to outline a specific and operational definition of teachers' beliefs and convictions, which embeds their identity and thereby scrutinizes the interplay between identity and assessment.

An unavoidable starting point when we want to identify beliefs and convictions related to mathematics teaching and learning is the notion of epistemology, as it has been discussed by Brousseau [36,37]. We therefore need to cast teachers' beliefs and convictions in epistemology and the related notions of cultural knowledge and personal knowledge.

D'Amore and colleagues [35] worked out the following definitions that are advantageous for our investigation.

An *epistemological conception* is a set of convictions and pieces of knowledge that tell us what the knowledge of individuals and groups of individuals is: its functioning, its forms of validation, its acquisition and its influence on teaching and learning. Epistemology is an attempt to identify and unify different epistemological conceptions related to a field of knowledge.

A *conviction* (or belief) refers to opinions, judgments and expectations: what one thinks about something.

The set of somebody's (A) convictions about something (T) gives the conception (K) of A related to T; if A belongs to a social group (S) and shares with the other members of S the same set of convictions related to T, K is the conception of S related to T.

*Knowledge* is conceived as a set of contents, attitudes acquired through study and experiences that are reproducible.

Within knowledge, the authors in [38] single out:

- *cultural knowledge* as the set of data, concepts, procedures and methods that exist outside the individual and belong to the cultural and historical dimension inscribed in texts, journals, encyclopedias, etc.;
- *personal knowledge* as being inseparable from the knowing individual that encounters cultural knowledge, makes sense of it, puts it in movement and transforms it in an object of *consciousness*; within Radford's [39] Theory of Objectifications (TO), personal knowledge can be seen as the result of a *process of objectification*.

Brousseau [40,41] introduces the concept of *school epistemology* to outline the combination of convictions, beliefs that circulate in the school system regarding the nature of knowledge, methodology, assessment, teaching and learning and the social and political role of mathematics. The school epistemology drives the didactical activity and design, influencing the choice of cultural knowledge to be taught, teaching–learning models and assessment.

In turn, the school epistemology must attend to the requirements of a larger social infrastructure whose epistemologies, values, systems of truths, rationalities and political standpoints inform educational activities that take place in the school. Therefore, a part of this broader social infrastructure will specialize in driving the relationship between the teaching system and its societal environment.

Chevallard [42] refers to this specialized part of society as the *didactic noosphere* (or simply noosphere), that is, the sphere of those who think about the teaching of mathematics: the aim of school, the goal of education, the expectations of society concerning education and culture, etc. It consists of all those persons who share an interest in the teaching system, including policy makers, curriculum developers, mathematicians, didacticians, the families, etc. The noosphere is the joining link between the school system (the teachers' choices included) and the broader social environment it belongs to [43]. In Section 2.2, we describe some of the features regarding assessment that characterize the Italian school system.

The issues of *stability* and *resilience* in defining teachers' identity is crucial [44]. The enforced introduction of digital technologies and LDL had to confront the features defining the teachers' identities mentioned above and the way they are influenced by the noosphere.

## 2.2. Assessment in the Italian Teachers Noosphere

Since the beginning of the lockdown, assessment has been a key topic, and the MIUR (formal recommendation N. 279, 8 March 2020) stated that the current legislation (Dpr 122/2009, D.lgs 62/2017), except for formal final certifications and state exams, hands over evaluations and assessments to the teacher, without fixing protocols which come more from tradition than from legislation [45] (p. 3, our translation). The reference is clearly to summative assessment, which in Italy is institutionalized by the Council of Teachers of the class at the end of each year and which has consequences on the career of the student.

Moreover, in Italy there is not a stable system of preservice teacher training (except for primary school teachers); most Italian mathematics teachers currently in service attended only courses centered on mathematics, and not on their professional development as teachers. Hence, “assessment” was not an explicit issue of their training, and, for instance, the different aspects of assessment (e.g., formative and summative functions of assessment) are not even known in many cases. There is a gap between the official normative, which stress the role of formative assessment, and the deeply rooted classroom traditions, centered on frequent summative assessments based on oral and written open-ended question, marked with grades from 1 to 10 [46,47]. Final grades are often decided via arithmetic means, sometimes calculated from qualitatively different grades. On the other hand, there is a long-standing thread of educational research on formative assessment [48]. Nevertheless, recent research shows how practice in classroom assessment is often far from both policies and research, and it is perceived by students as a distinctive feature of the personal profile of the teacher [47,49]. A teacher’s autonomy in the assessment processes is strongly defended. This explains the hard debates and the reactions against the introduction, in the Italian system, of a standardized external assessment focused on mathematics and Italian, which started in 2008: the so-called INVALSI tests [50–52]. Several analyses show that there is a very low correlation between internal assessments and external assessments: for instance, between the final grades at the end of secondary school and the results from university admission tests [53–55]. INVALSI tests and other large-scale assessments, such as OECD-PISA, highlighted deep inequalities in the rating of students by teachers, depending on schools, geographical areas and other variables [56,57]. The INVALSI tests of Spring 2020, during the COVID-19 lockdown, have been canceled.

### 2.3. Formative Assessment

Assessment processes should concern not only the learning of students, but the very nature of the school organization, curriculum and the teaching and learning process [58]. Assessment, as a regulatory process, does not come at the end of the learning path, but has value if it accompanies and regulates the didactic process. Otherwise, assessment would continue to be used with the mere function of control and the final and conclusive assessment of teaching and curricula.

Assessment is an integral part of teaching by means of judgments based on surveys, observations and analysis of processes and products. For instance, [59] provides an exhaustive and in-depth overview of assessment in mathematics, considering didactical, epistemological and historical aspects.

Formative assessment is a didactical tool for regulating teaching and learning focused on formative feedback [60]. Good feedback is rigorous, specific, critical, clear and projected towards future activities. Aimed at the orientation of learning, formative assessment is based on a control that is as analytical and reliable as possible of the knowledge learned and the skills developed. Furthermore, effective feedback follows rigorous criteria related to an observable applicable mastery scale [61]. Assessment is a means of learning because it focuses on sharing and actively using evaluation criteria. It is a process that foresees that the learner is an active subject rather than a mere object of evaluation. The use of self-assessment is an essential aspect of authentic assessment, although scarcely widespread in Italian schools according to what was declared by a representative sample of teachers [62]. It has positive effects on the intrinsic motivation and on the development of metacognitive skills, and allows students to use evaluation criteria as tools for reflection to guide their own learning path and personal growth. The teacher, student’s peers and the student him/herself are the agents of formative assessment, and research in the field shows that digital technologies can be a powerful tool for teachers in order to monitor students’ progress, provide immediate feedback to students, enhance self-monitoring of the students and highlight the deeper roots of an error [47,63–67].

#### 2.4. Research Questions

The strong rupture that the emergency brought into teaching–learning practices is that digital technologies have suddenly become the only means to carry out educational activities in mathematics. Teachers and learners have been abruptly thrown into a completely new social, psychological, emotional and political dimension characterized by unprecedented forms of practices and interpersonal interaction.

The aim of our research is to scrutinize how teachers' identities and beliefs relate to the new practices. We select assessment as the focus of our observation due to the heated debate on assessment started in April 2020 during LDL. The new learning environment involved students, teachers and schools in the intertwining of the Italian didactical noosphere and the context of the pandemic crisis.

More specifically, our study addresses the following research questions:

RQ1: What are the key features of assessment from the teachers' perspectives when adapting to the new situation, also taking into account the didactical noosphere?

This first question is necessary in order to shape the phenomenon of assessment in relation to the new environment, which is mathematics teaching and learning during the pandemic crisis from the teacher perspective. We explore one aspect of school epistemology, assessment, looking at its adaptation and transformation during the first months of LDL, and this leads us to the second research question:

RQ2: What does this adaptation process allow us to reveal about teachers' systems of beliefs regarding assessment and knowledge, both cultural and personal?

### 3. Materials and Methods

In order to collect information regarding the LDL situation among various school contexts, we distributed an online questionnaire. The aim of the questionnaire was to explore not only the different practices of LDL but also to uncover the different perspectives of the teachers involved as a starting point for further studies.

The questionnaire was administered during the month of April 2020 to gain information on the fluid process that began a month earlier and that was settling itself day by day.

To design the questionnaire, which we describe in the following paragraph, we referred to previous research about virtual classes [68] and assessment [46]. Nevertheless, we added specific questions related to teachers' experiences involving all aspects of the teaching and learning of mathematics. We decided to track a new phenomenon that was evolving daily; therefore, we could not establish a fully fledged validation process. Instead, we followed three subsequent steps of refinement. The questionnaire went through three different versions. We distributed the first pilot version between 8 and 9 April, the second pilot version on 10 April and the third (final) version remained active from 11 April until the end of the month. A qualitative and quantitative analysis of the data collected with the first and the second pilot versions allowed us to refine some questions and their formulation. The three versions of the questionnaire are for the most part stackable, except for the final part of the third version where we added more specific questions focused on assessment. In the beginning of April, a heated debate on assessment during LDL was the reason for such an addition. At the methodological level, we identified a first draft of categories from the answers to the two pilot versions. Subsequently, we reapplied them to the third version, identifying beliefs as trends in the responses associated with certain categories.

The lack of time due to the constant change in the emergency situation led us to select a convenient sample: the need to reach teachers during a fixed period of time guided the selection. We spread the questionnaire through mailing lists of teachers that collaborate with us in other projects, asking, when possible, to share it with others.

Overall, we obtained 70 answers from the first version, 54 answers from the second, and 244 from the third. In this article we focus on the data obtained from the third and definitive version of the questionnaire. The questionnaire contains open-ended and multiple-choice questions. Concerning open-ended questions, in the third version of the

questionnaire, we collected 200 answers out of the 244 involved teachers. Thus, in the following, the sample total will be 244 for the multiple-choices and 200 for the open-ended questions.

Teachers that answered the questionnaire come from all school grades. In the third version of the questionnaire, they are distributed as in Table 1.

**Table 1.** Schools the teachers involved belong to, divided by school level.

School	Frequency
Primary school	122
Lower secondary school	80
Upper secondary school	39
Other (University, Kindergarten . . . )	3

The questions are designed in order to make explicit the aspects of school epistemology in the LDL environment together with the description of the newly implemented practices. This allows us to shape assessment in relation to other dimensions of teaching and learning during the pandemic induced by LDL, that is, technological background, perspectives on LDL, mathematics and beliefs related to personal and cultural knowledge:

- Technological background: the first section was made up of multiple-choice questions designed to understand what the effective teacher practices were during LDL. The last question of this section is an open-ended question about the teacher's future intention regarding practices and tools they will continue using once they are able to return to the school building.
- Perspective on LDL: the aim of this section was to position the teacher's perspective in relation to the virtual classroom and the use of digital technologies. Teachers' agreement/disagreement towards virtual classrooms was analyzed via collected and validated data coming from a previous questionnaire developed in the Vir-Math [65] project.
- Mathematics: the questions in this section investigate the mathematics lesson in relation to the school curriculum, specific teaching choices concerning content knowledge and the forms of communication used by teachers and students.
- Assessment: this last section presents open-ended questions about students' performance as perceived by teacher, about student assessment and the perspective of the teacher about the possibility to assess students during LDL. A set of multiple-choice questions was also present with the intent of understanding the assessment practices during LDL compared to usual practices and their feasibility.
- Future intentions: the last open-ended question was presented to allow teachers to express their intentions and their perceived outcomes on the basis of the first month of LDL.

#### 4. Results

The data we have collected provide a picture of LDL experienced by Italian teachers in April. We describe below for each section of the questionnaire our data, highlighting those directly related to assessment.

##### 4.1. Technological Background, Perspective on LDL and Mathematics

Regarding the technological background, we organize the various software used by the teacher into four categories, depending on their distinctive usage. Data from this section are presented in Table 2. Data show a strong increase for all the categories, with an obvious upsurge for software for managing synchronous lessons.

**Table 2.** Frequency of the use of various software categories, before and after LDL.

Tool to	Before LDL	During LDL
Manage synchronous lessons (e.g., Google Meet, Zoom, . . . )	18	177
Manage asynchronous didactical practices and didactical flows (e.g., Google Classroom)	57	140
Create, manage and/or archive digital resources (e.g., Google Drive, slide presentations, documents, video, . . . )	85	181
Create and manage online surveys (e.g., Google Forms)	41	95

In the same section of the questionnaire, we propose questions to investigate the frequency—always, often, rarely, never—of various didactical practices (multiple-choice Q9), and of several communicative behaviors (multiple-choice Q10). From the answers, considering the frequencies of always and often, it appears that most of the teachers organize online meetings with the students (about 69%), share various kind of materials with them (e.g., about 31% send students a video recording of the synchronous lesson, about 94% send individual activities to students and about the 85% of teachers receive pictures of homework). Regarding communication specifically, 75% of teachers involve students individually by asking questions during meetings, and we can see a gap between the private communication with each student (about 71%) and the communication in spaces shared with the whole class (50, 82%). The situation changes when speaking about group work and interaction between students. About 49% of the teachers involved state that the students never carry out group work by collaborating at long distance, and only 16% state that students do it often or always.

When asked about their future intention (open-ended question Q12) regarding the use of digital technologies in their classrooms, most of the teachers refer to the positive effects of using digital technologies for the interaction between the teacher and a single student: 84 teachers out of 200 answering the question refer to ways of interacting with students and to tools used during LDL that allow for a better interaction during and after school time. Twenty-six of them refer directly to the possibility of fostering the individualization of teaching offered by using digital technologies.

Regarding the Perspective on LDL section, it can be seen that 52% of the involved teachers disagree with the sentence, “In this period of LDL I feel a decrease in the quality of my work”, and about 70% agree with the sentence, “The fact that I am in constant contact with my students makes me feel very present at an educational level”.

Along with these sentences, which show a certain confidence in the possibility of continuing an educational relation even during lockdown, 90% of the involved teachers agree with the sentence, “My working time for the lesson design has expanded”.

Regarding more specifically formative assessment, in the sense of [60], more than 60% of the teachers agree with the statement, “I am able to give feedback to each student for each task they perform, and it seems to me that some of them are improving”.

Regarding the Mathematics section, it emerges that most of the involved teachers are addressing a new topic, and only 15% are reviewing an old one.

Regarding the level of difficulty, most of the teachers (about 94%) point out that it did not change substantially, and 59% of the teachers did not lower their learning standards, as shown in Figure 1.

About 61% of the teachers state that they did not lower the standard of learning outcomes expected from their students (Figure 2).

Globally, results in these three sections lead us to better specify some crucial elements that characterize the school and the didactical environment during the pandemic-induced LDL experience. The teachers’ answers to these sections allow us to outline some initial information about their personal LDL experience. Indeed, in order to understand the emerging school epistemology in this situation, we first need to focus on the peculiarities of the teachers’ didactical practices after almost 2 months of LDL. Results in these sections



highlight that teachers recognize the positive effect of digital technologies in terms of interactions between the teacher and each student. Moreover, it emerges that most teachers did not lower the level of difficulty nor change the standard of the learning outcomes expected from their students.

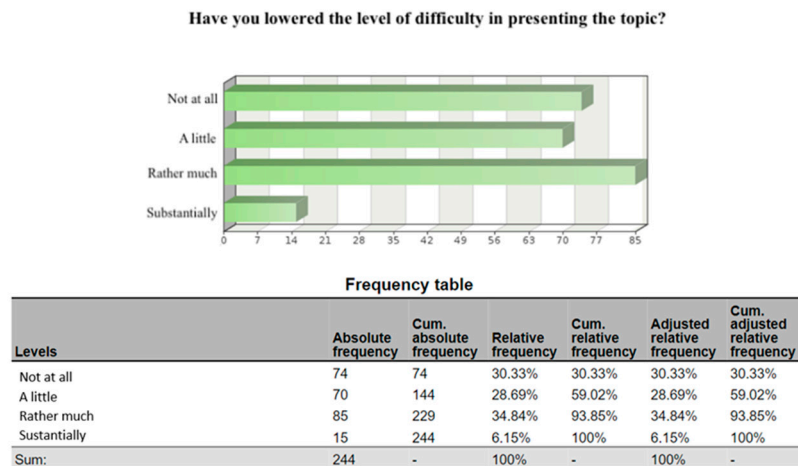


Figure 1. Frequency table of the question Q17-a.

Have you lowered the standard of learning outcomes expected by students?

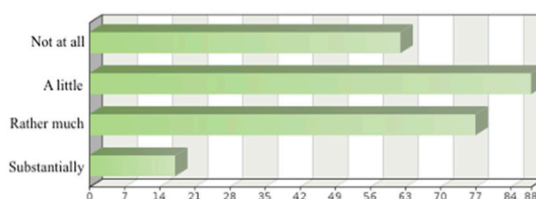


Figure 2. Histogram of the question Q17-b.

#### 4.2. Assessment

The questions we analyze here are six: three multiple choice (Q25, Q28 and Q30) and three open ended (Q26, Q27 and Q29, which is related to Q28).

Q25 presents a grid of possible ways to supervise students’ learning: the teachers are asked to compare their practices before and during the lockdown. The data show that teachers’ assessment practices are affected by digital technology in different ways. On the one hand, teachers engage in new practices that are available due to the implementation of digital technology. For example, they become aware that they can exploit the potential provided by learning platforms, such as Google Classroom, Microsoft Teams, Google Meet, Moodle, Zoom, Skype, etc. They exploit synchronous and asynchronous practices fostered by digital technology. In addition, they can exploit possibilities offered by digital technologies to enhance the range and depth of assessing: online forms, questionnaires, individualized feedback (e.g., via email), etc.

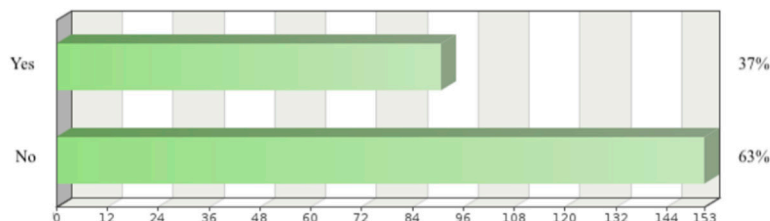
Of the respondents, 37% indicated that they started using online forms during LDL and 38% that they are giving more individualized feedback to students than before. Digital technologies provide a wide range of possible activities that could be carried out both in LDL environments and in the physical classroom.

On the other hand, 43% of the teachers that answered the questionnaire indicate that observing students while they interact is not feasible anymore and 38% that peer review situations are not possible in an online environment.

In addition, moments of collective discussion seem critical from the teacher’s perspective: 37% of the teachers choose the option, “Before I used to do it but now it is not feasible”, regarding involving students in class discussion.

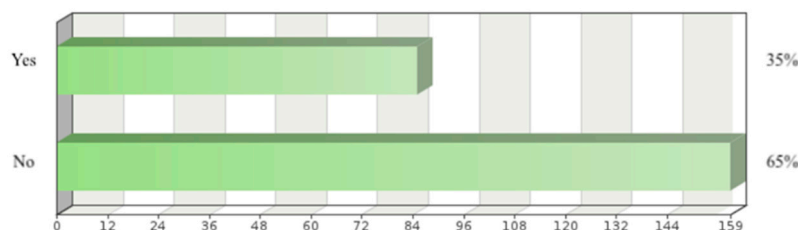
Answers to Q28 and Q30 (Figures 3 and 4) show that most teachers do not consider assessment a viable activity in LDL environments.

**After these first weeks of LDL, do you think it is possible to "evaluate at a distance"?**



**Figure 3.** Histogram of the question Q28.

**Have you been giving grades to your students in recent weeks?**



**Figure 4.** Histogram of the question Q30.

Concerning the open-ended questions, let us recall them here:

- Q26: Regarding the monitoring process during this period of LDL, please indicate at least one positive and one negative aspect that you have found.
- Q27: Regarding this period of distance learning, did the student's performance improve/upgrade? Why?
- Q29 (related to Q28): Why?

An in-depth analysis of the answers sheds light on the different aspects related to the evaluation in the new environment.

LDL pushes teachers to question the different aspects of evaluation, especially in reference to the digital environment. From the teachers' answers, a great variability regarding the adaptation of assessment to the new situation emerges.

We can see references to the evaluation of student performance, the curriculum implemented in LDL and teaching.

Teachers that answer the questionnaire state that they cannot carry out any form of assessment that could be considered valid, true, ethical, normatively acceptable, meaningful, etc.

Answers to Q29 provide a justification to the previous answer in Q28 (see Figure 3). Among the justifications for "It is not possible to carry out any form of assessment", one of the most recurrent elements (we detect it in the 61% of the responses) refers to the absence of authenticity, the lack of "control" of the whole set of variables that usually allow teachers to supervise the situation.

A result of this feeling is the lack of authenticity perceived in the tasks performed by the students. In particular, the role of parents appears to be a strong influential factor. Among the justifications for "It is possible to carry out any form of assessment", one recurrent element that appears to be influential in students' evaluation is related to their previous knowledge or to information coming from the months preceding LDL. For instance, a teacher answered Q29 as follows:

"At least in the higher grades, each teacher already knows their students and is therefore able to evaluate the work done, possibly separating it from the

‘contributions’ of parents. In addition, it is possible to evaluate the skills acquired because in this situation students are developing many of them. It is a question of seeing how they use the knowledge that we have provided them in previous months and years: perhaps this is the most important aspect to evaluate.”

Parents’ intervention—along with its relationship to assessment—occurs in the answers to other open-ended questions as well. For instance, in Q27 there are 55 of 200 teachers who relate performance evaluation to parent intervention, both in the negative and positive sense. Parents’ intervention has an impact especially regarding primary school student evaluation: among the 55 teachers that relate parents’ intervention and assessment, only eight are secondary school teachers. For instance, a teacher explained that “It is not possible to give an evaluation of their performance due to the intervention of parents in the homework”. As an example of a positive version of parent intervention, a teacher states that “The students’ performance may have improved slightly because they are followed more by their parents at home”.

Some teachers make explicit reference to the distinction between summative and formative assessment in relation to LDL. A wide variety of opinions appear, most of them linked to the impossibility of implementing summative assessment because of the lack of control and authenticity of students’ work.

In relation to formative assessment, we can affirm that technologies give a wide range of possibilities to perform formative assessment in the sense introduced in the theoretical framework. Nevertheless, one of the findings related to these questions appears to be the lack of consistency between the definition of formative assessment proper to research in mathematics education and that expressed by teachers. They seem to focus on students’ behaviors, disregarding mathematical knowledge, e.g., punctuality, attendance, commitment, etc.

We list below some answers to Q29 that reveal teachers’ beliefs regarding formative assessment:

- “Assessment is an extremely delicate process in presence, “remotely” it is not even conceivable to manage even the simplest aspects, such as formative assessments, let alone the major complex ones related to the acquisition of skills.”
- “Worse because students see that we appreciate a generic ‘commitment’ and no longer care about the content as they would do in presence. . . ”
- “I believe it is possible only with an assessment that does not take into account content knowledge, but an assessment of digital skills, the ability to adapt to new situations and commitment.”

Analyzing these examples, it seems as if mathematical content is not considered as the kernel of formative assessment.

## 5. Discussion and Answers to the Research Questions

The process of adaptation to the new situation varies depending on the individual teacher, but one of the results that emerges is that the majority of teachers pursued teaching. Most of them were dealing with a new topic in April. They adapted to the new environment in more or less effective ways, making use of the possibilities and resources offered by the digital environment. Thus, they modified the teaching sequence and redesigned it when necessary (see Section 4.1). At the same time, it appears that teachers have not identified valid assessment methods, in particular summative assessment, perceived as unreliable (see Section 4.2).

What emerges strongly is that most teachers believe that it is not possible to evaluate at a distance. If we look at those who support the possibility of evaluating at a distance, only a few suppose that mathematical content knowledge, and not aspects related to participation, punctuality, etc., can be assessed.

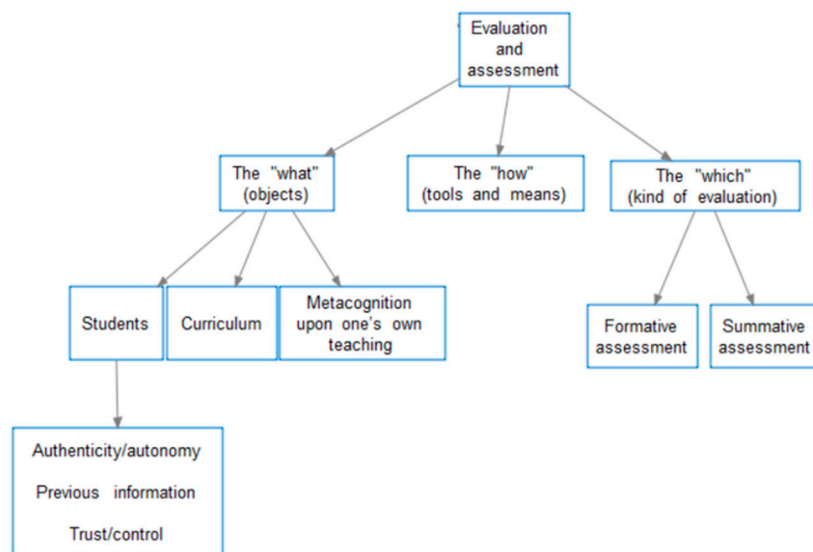
In general, there seems to be some obstacles to overcome, specifically in the adaptation of assessment to the new context.

Obstacles related to the adaptation of assessment in the LDL environment lead us to answer the first question RQ1. Teachers' conceptions about assessment can be inferred by their description of these obstacles, and this brings us to the answer of question RQ2.

RQ1: What are the key features of assessment adaptation to the new situation from teachers' perspectives that also exist in relation to the noosphere?

As we mention in the results section, teachers' answers show a great variability regarding the adaptation of assessment to the new situation.

Referring to [59], we organize and summarize the aspects that the teachers express as the most significant regarding assessment in the diagram in Figure 5, adapted from [68].



**Figure 5.** Diagram of the categories related to assessment from questionnaire answers.

Each teacher, trying to adapt her practices in relation to assessment, reflects and makes decisions along some of the directions shown in the diagram (Figure 5).

We found that the adaptation of assessment and the possibility of overcoming the resulting obstacles is linked to some beliefs about assessment, which emerge throughout the questionnaire.

As shown in the results, the most significant categories related to the impossibility of assessment are the ones that refer to authenticity and to summative assessment. On the other hand, the most significant categories related to the possibility of assessment are the ones that refer to previous information about each student and to formative assessment. However, it is necessary to recall that one of the findings of the questionnaire was that formative assessment in teachers' answers acquires two distinct meanings, one consistent with Black and Wiliam's definition [60] and the other related to the assessment of performances not related to mathematical content.

We can conclude that there is a strong resistance to adapting assessment processes to the new LDL learning environment. The interesting result is that teachers feel that "true" assessment—from the teachers' perspectives, summative assessment—is not possible in the new environment because it clashes with established practices and conceptions strictly related to role of the didactical noosphere as mentioned in Section 2.2. There is a gap between the school system and the broader social environment in two directions. On the one hand, the school system has not accepted the results that educational research regarding assessment and curriculum, both in general didactics and mathematics education, has validated several times. On the other hand, there are long-standing values coming from society—such as an individualistic conception of knowledge considered to be a kind of commodity [39]—that require objective, measurable and controllable forms of transmission and assessment, as well as ethical issues. The noosphere should round this kind of influence on the school system and bring into society a new vision of education and mathematics

teaching and learning. All in all, our data show the strength of school epistemologies, driven by the noosphere, in defining the kind of requirements for assessment in the LDL environment.

Within this framework, the qualitative content analysis of the teachers' answers to the open-ended questions allowed us to answer our second research question.

RQ2: What does this adaptation process allow us to reveal about teachers' beliefs related to assessment?

As stated before, the decision-making process of the teacher is interrelated with her beliefs and therefore with her school epistemology. According to our results, the control theme seems to be a crucial point regarding the feasibility of assessment:

1. Assessment is not possible when the teacher relates the idea of control to authenticity and to summative assessment.
2. Assessment is possible when the teacher relates the idea of control to the students monitoring and to an exchange of materials, information and feedback.

In the same direction of statement 1, another aspect that emerges from the results is the idea that authenticity is possible only when the students are working alone without any external help.

The problem most evidently related to evaluation is that of the control and authenticity of the students' papers, in particular when speaking about summative assessment. The strong percentage of teachers that refer to the idea of control in answering question Q29 highlights a vision of assessment that differs from that coming from research in mathematics education. A vision related to the teacher's beliefs strongly affects their practices and identity when it cannot be carried out. Parents' intervention in this context appears to play a prominent role. It guarantees assessment, together with methods that allow for the control of the student's behavior during tests, considered as a specific and isolated moment in the school time and not part of the educational relationship.

Teachers feel that the new environment hinders the observation of students' interactions and of students' actions in general. The adaptation of assessment reveals a conception that stems from a defined epistemological conception of mathematics, its functioning and its forms of validation and acquisition, and therefore its teaching and learning. We found contradictions between indications coming from the didactical noosphere, in particular from official normative and educational research, which stress the role of formative assessment (Section 2.2) and school epistemologies related to classroom traditions. What emerges from the answers to the questionnaire is that cultural knowledge and personal knowledge are somehow overlapped. The path that the student has to cover to encounter cultural knowledge, making sense of it and transforming it into an object of consciousness, is disregarded. Therefore, what counts and is meaningful for assessment is an impersonal mathematical object that we can control and measure as something objectively transferred from the teacher into the "student's head". A conception of mathematics and its learning that recognizes the intertwining of cultural and personal knowledge entails a broader conception of assessment "where teachers and students [...], are individuals with a vested interest in one another and in their joint enterprise; individuals who intervene, transform, dream, apprehend, suffer, and hope together" [69], p. 265.

In the same direction of statement 2, the answers to the questionnaire strongly spotlight a new awareness of the possibilities that new technologies offer in terms of individual interaction with the student and the individualization of education. Technologically speaking, learning platforms provide several possibilities both to accomplish and observe students' interactions. Regarding formative assessment, digital technologies provide many possibilities for the class, though our sample revealed that a low awareness of the meaning of formative assessment emerged.

## 6. Conclusions

The data show that teachers inscribe themselves in the new social and political environment that stems from the COVID-19 crisis, implementing new forms of teaching and

identifying new forms of interaction with students allowed by digital technologies. At the same time, significant difficulties emerge regarding evaluation and, in particular, summative assessment. These difficulties are due in part to a partial knowledge of the possibilities offered by technologies and, in part, to the sociopolitical context in which the teacher acts. The sociopolitical context stresses, on the one hand, the great importance of the summative assessment in ranking students' performances. On the other hand, it highlights the benefit of formative assessment and gives partial autonomy of decision to schools in relation to evaluation. In the context of LDL, even summative assessment is perceived as inauthentic and meaningless since it lacks control of the students and of all the variables involved. The strength of teachers' beliefs does not allow them to include formative assessment as an educational strategy, even when research and current legislation (Dpr 122/2009, D.lgs 62/2017) point in that direction, especially during the pandemic crisis. Teachers' beliefs regarding assessment entail a "pressure to perform" that has a negative influence on students' learning and self-efficacy.

Regarding teachers' beliefs related to assessment, we testify a generalized misunderstanding of the definition of formative assessment as given by Black and Wiliam [60]. Thus, teachers are led to consider only summative assessment as a tool to investigate and give feedback about the "learning of mathematics" (and specifically, the acquisition of mathematical content). Formative assessment is instead considered to be the evaluation of other students' actions, e.g., participation, punctuality, transversal skills, etc.

This misconception leads to the underestimation of the possibilities offered by digital technologies when considering assessment and to the reduction of the sense of effectiveness of teachers in a virtual environment, especially regarding the evaluation of mathematical content.

We must nevertheless consider the limitation of the questionnaire in relation to the investigation of this issue, which emerged from the teachers' answers to questions not designed for this aim. More generally, this questionnaire can be considered as a first step in the exploration of a phenomenon that deeply changed the school's physiognomy, born in a context where change needed to be investigated quickly. Future research may arise from more careful planning, with a focus on validating and deepening these early exploratory studies.

To conclude, we can affirm that pinpointing difficulties associated to the ability to evaluate LDL can be helpful to understand how to address the issue of evaluation in general and the possibilities offered by digital technologies. In particular, it seems promising to consider how teachers' beliefs clash with the definition of summative and formative assessment developed by educational research. In addition, further insights about teachers' beliefs could come from the analysis of new possible forms of assessment in the broader context of their school epistemologies and of the normative Italian system. The risk of facing a new school closure impels further inquiry into the issue of evaluation during LDL. Teachers need operational tools that take into account different perspectives on assessment and different school indications with respect to the normative ones.

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