Teacher Training on Data Literacy for School Evaluation and Improvement: A Teacher Professional Development Experience in Italy

Michela Freddano[1], Valeria Pandolfini[2]

[1] *Italian National Institute for the Evaluation of the Education System (INVALSI), Roma, Italy*
E-mail: michela.freddano@invalsi.it
ORCID: https://orcid.org/0000-0001-8053-3648
(Corresponding author)

[2] *University of Genoa, Genova, Italy*
E-mail: Valeria.Pandolfini@unige.it
ORCID: https://orcid.org/0000-0002-6880-705X

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Abstract
This paper presents a teacher training experience involving 674 Italian teachers working in primary and secondary schools in Liguria Region, in the North of Italy. The course aims to train teachers in analysis, interpretation and use of data emerging from the census-standardized tests by the Italian National Institute for the Evaluation of the Education System (INVALSI) for the assessment of students' learning in Reading, Mathematics and English language at different school levels. The paper contributes to the debate on teachers' data literacy by describing the experience and discussing preliminary results from two online surveys of teachers attending the training course (completed respectively, by 452 teachers, totaling 67.1% of the overall population attending the course, and by 413 out of 515). The first survey was administered at the beginning of the experience, exploring teachers' previous professional development experiences of evaluation topics, their expectations in relation to the course and self-efficacy of evaluative and educational strategies. The second survey was administered as a satisfaction questionnaire at the end of the training course to teachers who attended the online laboratories. Differences among primary and secondary school teachers are discussed, together with teachers' level of satisfaction for the training course. The paper stresses the importance to train teachers in data literacy, as a challenge for training teachers in the 21st century, and it encourages teacher professional development initiatives promoted by public authorities at local levels in order to better meet the specific local needs.
Keywords: teacher training, data literacy, students learning assessment, national standardized tests, large-scale assessment study, INVALSI, teacher professional development.

Подготовка учителей к грамотной работе с данными для оценки и улучшения работы школы: опыт повышения квалификации учителей в Италии

Микела Фреддано[1], Валерия Пандольфини[2]

[1] Итальянский национальный институт оценки системы образования (INVALSI), Рим, Италия
E-mail: michela.freddano@invalsi.it
ORCID: https://orcid.org/0000-0001-8053-3648

[2] Университет Генуи, Генуя, Италия
E-mail: Valeria.Pandolfini@unige.it
ORCID: https://orcid.org/0000-0002-6880-705X

Мнения, выраженные в этой статье, представляют собой точку зрения авторов и не обязательно отражают официальную политику или позицию INVALSI.

Аннотация
В статье представлен опыт повышения квалификации итальянских учителей, работающих в начальных и средних школах региона Лигурия, на севере Италии. Курс направлен на обучение анализу данных, полученных в результате проведения стандартизированных тестов Итальянского национального института оценки системы образования (INVALSI), а также их интерпретации и использованию с целью повышения успеваемости учащихся по чтению, математике и английскому языку на разных уровнях обучения. Статья включается в дискуссию о грамотной работе учителей с данными, поскольку описывает опыт и анализирует предварительные результаты двух онлайн-опросов учителей, принимавших участие в курсах повышения квалификации (опросник заполнили 452 учителя, то есть 67,1 % от общего числа участников курса, и, соответственно, 413 из 515). Первый опрос был проведен в начале курса, с целью изучения предшествующего опыта учителей в области оценки, их ожиданий от курса и самоанализа эффективности оценочных и образовательных стратегий. Второй опрос, посвященный удовлетворенности курсом, был проведен в конце обучения, в нем приняли участие учителя, которые посещали онлайн-лаборатории. В статье обсуждаются различия между результатами, полученными от учителей начальной и средней школы, а также уровень их удовлетворенности курсом. Статья подчеркивает важность грамотной работы с данными, как необходимого качества педагогической подготовки, и поддерживает инициативы по повышению квалификации учителей, выдвигаемые местными органами власти.
Ключевые слова: подготовка учителей, грамотная работа с данными, оценка успеваемости учащихся, национальные стандартизированные тесты, широкомасштабное оценочное исследование, INVALSI, повышение квалификации учителей.

Introduction

In Italy, the culture of evaluation has developed under the impulse of large-scale assessment surveys (at national and international levels) and the introduction of the Presidential Decree n. 80/2013 of the Italian School National System of Evaluation. Consequently, since 2015, each Italian school has to undertake self-evaluation and to complete a self-evaluation report and, since 2016, has to define improvement actions to achieve and to realize a three-year school improvement plan. The assumption is that school has to pass from self-evaluation to planning through 1) reflecting on data collected during self-evaluation, 2) selecting priorities, and 3) defining priorities in a strategic plan.

In Italy, the evaluation of the instructional system is the other face of school autonomy. Schools organize and take decisions on didactical strategies with the aim of increasing the learning objectives specified in the national curriculum from the first to the eighth grade of schooling and into the guidelines for the secondary school (from the ninth to the thirteenth grade). At the same time, each school year, the Italian legislator provides national testing at census level for assessing student learning at different grade of schooling (2nd, 5th, 8th, 10th, and the last year of the high school).

At the national level, data from testing hold the state accountable for the conditions of the national education system in term of students' learning quality and social inequalities and to underline points for attention. At the same time, the large-scale studies of student assessment offer theoretical material and data for schools that allow principals and teachers to take decisions for school improvement.

In this way, the aim of the School National System of Evaluation is not limited to a summative evaluation students' learning, but to improving learning itself: it is not a matter of evaluating learning, but of "evaluating for learning" (Graue & Johnson, 2011). The purpose of the evaluation is not only certification, but also diagnostic: this means that it has to be able to provide useful information to intervene and improve the educational system. Indeed, empirical evidence shows that results of student learning achievement are useful for school improvement if they are related to the observation of educational processes within the schools. Therefore, the key issue is how the evaluation procedures, and more specifically the results of the Italian National Institute for the Evaluation of the Education System (INVALSI), can help to define concrete school improvement plans (Sestito 2013:72).

This implies involving teachers personally in the identification of improvement objectives and in the definition of times and methods to pursue them, as well as sharing systems for monitoring and evaluating the results achieved thus making it possible to reflect on what and what did not work. This approach can promote a shared path, aimed at achieving the strategic step of leading each school from the analysis of self-evaluation data and Invalsi tests to the planning and implementation of improvement plans (Faggioli, 2014).

The training experience discussed in this paper aims at providing teachers with proper skills, making them full-fledged actors in the change of educational processes, towards the improvement of students' learning achievements and, more generally, of the quality of teaching and learning processes.

Purpose and objectives of the study

The paper discusses teacher training using data from the standardized INVALSI tests involving 674 Italian teachers working in primary and secondary schools in Liguria Region, in the North of Italy.

The course aim is to train teachers in analysis, interpretation and use of data emerging from the assessment of students' learning in Reading, Mathematics and English language at different school levels. The main goal is to train teachers to use of evaluative data on student assessment to plan instructional practices for improving student learning. The teacher training contents satisfy the needs expressed by schools and regional public educational authorities about the necessity to empower teachers in data literacy; mainly to understanding and using of INVALSI tests data, for improving the quality of teaching and learning processes as well as school educational and organizational strategies. The 10 Ligurian Polo schools for teacher training established a formal school network, with the support of the Liguria School Regional Office, for organizationally and economically sustaining the planning and the implementation of teachers' training course.

The training course started in November 2019 with five face-to-face plenary sessions, gathering 529 teachers working into the four provinces of the Liguria Region. Due to the pandemic COVID-19, the planned face-to-face training workshops for teachers took place at distance, through online platforms, involving 515 teachers from November 2020 to January 2021, with 370 teachers participating in both.

The study aims to present and discuss the judgments and opinions expressed by teachers who participated in the training course and completed two online surveys. Firstly, through data analysis it explores teachers' previous professional development experiences on evaluation topics, their expectations in relation to the course and self-efficacy of evaluative and educational strategies. Secondly, it investigates the teachers' level of satisfaction for the training course, referring to specific elements of the online laboratories (such as organizational aspects and the technology and effectiveness of the online training platforms), and gathering emerging training needs after the course's attendance.

The broader aim of the paper is to provide recommendations for teacher training models based on empirical data, to improve teachers' evaluation and assessment practices embedded within a consistent framework and so to improve the quality of teaching-learning processes.

Literature review

A culture of evaluation is now widely found in major educational systems around the world (OECD, 2013); student assessment, school evaluation, and educational system evaluation have become key aspects for school improvement.

The promotion of national and international large-scale assessment studies on student learning, through political will and the development of new technologies in data management, allows researchers and professionals to have a large amount of rigorous data on student learning assessment.

Large-scale studies on student assessment offer data to policy-makers for taking decisions and guiding public policies at macro and micro level. At the national level, data are useful to hold the state accountable for the conditions of the national education system in term of students' learning quality, social inequalities and to underline areas for attention. Moreover, large-scale studies on student assessment offer theoretical material and data for schools that can allow principals and teachers to take decisions for improvement at school and classroom levels (Scheerens, 2016).

However, having many data does not mean to be able to use them. Effective use of data requires the ability to read and interpret them for decision-making. Data-driven decision-making is based on evidence rather than anecdotes, insights, or personal preferences (Mandinach & Gummer, 2013). However, teachers need time and reading skills for using data (Castoldi, 2012) rather than assessment illiteracy (Magnoler, 2012; Xu & Brown, 2016).

Having broad and rigorous databases could allow schools to reflect critically on the profile of their institution and therefore could be a valid help to proceed along the path of self-evaluation. However, having data without the resources to interpret them leads to the risk of not basing the interpretation on the collected evidence but venturing along other paths. It is difficult for schools to gather evidence and document their work and even more to read the data (in the sense of assigning meaning), when they are made available through large databases. Three aspects are required: to be able to read critically the data made available by others, to know how to collect useful data independently (when one becomes aware that evidence is insufficient for self-evaluation), and to have the necessary

resources (e.g., time and professional skills) to control the gap between expected results and collected data (Robasto, 2017).

Adequate skills in analyzing and using evaluative data for improving teaching and learning processes are major challenges for the teaching profession (OECD, 2018). However, few educators have received sufficient training or preparation in statistical assessment (Wallman, 1993; Stiggins, 1995) or, more in general, data literacy (IRMA, 2018; Mandinach & Gummer, 2016; Mandinach et al., 2015).

The assessment literacy consists of knowing how to use consciously the data provided by the evaluation (Stiggins, 1995; Brookhart, 2011; Mandinach and Gummer, 2016; Xu and Brown, 2016; Pastore, 2020). While statistical literacy is the ability to critically understand and evaluate the statistical results that impact on everyday life, together with the ability to appreciate the contributions that statistical thinking can make in the public in the private sector, in professional and personal decisions (Wallman, 1993; Sharma, 2017). Data literacy is a more general and inclusive definition and means different things to different stakeholder groups. Gummer and Mandinach (2015:2) defined data literacy for teachers as "the ability to transform information into actionable instructional knowledge and practices by collecting, analyzing, and interpreting all types of data (assessment, school climate, behavioral, snapshot, longitudinal, moment-to- moment, etc.) to help determine instructional steps. It combines an understanding of data with standards, disciplinary knowledge and practices, curricular knowledge, pedagogical content knowledge, and an understanding of how children learn". Starting from this assumption, promoting training courses for teachers on data literacy professional development is important.

Methodology

The paper presents a teacher training experience involving 674 Italian teachers of Italian language (34.3%), Math (35.2%) and English language (30.5%), equally distributed in primary, middle and secondary schools in Liguria Region, in the North of Italy. The first meeting in November and December 2019 was face-to-face with 159 teachers (23.6%); there were 145 participants (21.5%) at the online laboratories only, and 370 (54.9%) attended both. The first questionnaire was administered to all 674 participants with a response rate of 67.1% (n=452). Of the respondents, 26.5% were from primary schools, 40.7% from middle schools, and 32.8% from high schools. Females, on average 51 years old, accounted for 90,3% of the respondents. The majority (40.5%) followed math courses, following by reading literacy (33.6%) and English (25.9%).

The second questionnaire, exploring satisfaction was administrated to the 515 teachers who attended the online laboratories. The teachers' sample was composed of 413 subjects, with a response rate of 80.2%.

The description of the characteristics of the respondents, their attitudes and opinions are given below. Both descriptive quantitative and qualitative analyses were carried out. Particularly for the first questionnaire, descriptive analysis was undertaken on the questions on (i) the previous experience of professional development, (ii) the knowledge of the national testing's theoretical framework and (iii) about personal expectations of the training course. Finally, a Promax rotation factorial analysis had been run on a question on the sense of literacy, composed by 9 item and a Likert scale of five steps from 1 to 5, where 1 correspond to "Very illiterate" and 5 to I "Very literate".

For the second questionnaire, on customer satisfaction, a descriptive analysis was carried out on three questions (i) on general satisfaction, (ii) on theoretical aspects and (ii) the implementation of the training course. The emerging needs for professional development had been explored.

Results

Teachers' experience of professional development, expectations and sense of literacy

Training evaluation, improvement and social reporting in the two previous years was reported by 38.3% of the respondents. There were many differences between the grade of schooling: in primary schools, 47.3% of teachers had such training compared with 43.6% teachers from middle schools. In contrast on 27.3% of teachers from high schools has training courses on these topics. This reflects the tendency of a greater investment in professional development on the topics of evaluation literacy from Italian teachers from primary and middle schools than teachers from high schools.

A specific question asked about the teachers' knowledge of the theoretical framework of the national standardized tests, starting from the fact that Invalsi publishes the theoretical framework into its online website and systematically informs schools. Only 4.6% of the respondents did not know those documents and only 9% knew it but did not read them; 43.0% of respondents read it rapidly and 32.6% read it in detail. A large proportion of teachers in primary schools (42.7%) read the documents in detail, contrasting with only 28.5% of teachers from middle and secondary schools.

Differences emerges between teachers from different school grades with regard to expectations. Half of the teachers would like to improve the efficacy of their lessons (47.4%), with a higher score from teachers in primary school (55.4%) and middle schools (51.2%) contrasted with that from the secondary schools (37.5%).

Another expectation is in the design of skills-centred learning pathways. This was chosen by 43.5% of the teachers, with an interest that progressively decreased from teacher in primary schools (55.4%) to those in secondary schools (36.0%).

The possibility of a better understanding of the results from standardized Invalsi tests was chosen by 31.0% of teachers with no differences between the grade of school, while 30.5% wanted to improve their use of Invalsi data in their pedagogy.

These two expectations are central for the topic of the training course. Differences among grades emerge for two items regarding how to better teach to the national tests and how to engage students to do the national test. That concerns whether or not the test topics are high-stake. The national testing has the aim of assessing the national education system of instruction and does not have an impact on students' success. Teachers from high schools (21.6%) and from middle schools (13.4%) but with a minority of teachers from primary schools (7.1%) expressed their expectations to learn strategies to engage students in national testing. Moreover, 27.3% of teachers from secondary schools, 17.4% of teachers from middle schools and a minority of 8.9% of teachers from primary schools expressed the expectation to be able to explain better to students how to support the national testing. Those data show a particularly need for professional development of teachers from high schools. The expectation for projecting innovative didactical units was expressed by 25.1% of teachers (33.0% for teacher in primary schools, 23.8% in middle schools and 20.9% in high schools).

Some teachers (21.9%) had the expectation of improving students' evaluation strategies, with no differences among grades. But only few teachers (14.4%) expected to learn how to personalized the student learning track, making comparisons with other teachers (14.8%), learning about innovations or new ways of teaching (11.4%), or applying new evaluation strategies (10.3%), with no differences among grades.

Finally, the factorial analysis on the 9 items from the question regarding the teachers' perception of preparation use a 5-point Likert scale (from 1 "very literate" to 5 "very illiterate") was used to estimate two factors.

The first scale regards teachers' perception of their literacy on Invalsi testing, based on four items (Cronbach alpha = 0.75): "Read and understand the results of the Invalsi

tests of my classes"; "Identify strengths and weaknesses of teaching on the basis of the analysis of the results of the Invalsi tests"; "Explain to students how to take the Invalsi tests"; "Improving classroom activity in the light of the results of the INVALSI tests".

The second scale regards working for skills (Cronbach alpha = 0.75) was based on three items: "Creating learning units for skills", "Insert skills assessment tests into the classroom activity" and "Define effective learning assessment strategies".

On a scale from 1 to 5, on average, respondents feel more confident with the topic of Invalsi tests (3.23) instead of working for skills (3.03), with a similar trend in grades. It is interesting to analyze the differences within the scales. On both scales, teachers from middle and high schools recognize themselves more competent than teachers from primary schools: for the first scale, 3.19 at primary school, 3.26 at middle school and 3.23 at high school; for the second scale, 2.98 at primary school, 3.03 at the middle school and 3.09 at high school.

Participants' satisfaction: evidences from the satisfaction questionnaire

The respondents to the satisfaction questionnaire administered at the end of the virtual laboratories comprised 39.0% middle school teachers, 31.7% of secondary schools' teachers and 27.1% primary schools' teachers (a residual 2.2% is defined by the missing cases). The sample had the following features: a prevalence of females (89.4%), and an average of senior age (mean age of 51 years). More than half of the sample (52.5%) were in the 50-59 years' age group, one in 10 respondents was over 60 years old (11.4%); less than one third of the sample (32.4%) were in the 35-49 years' age group, while only 3.7% respondents were less than 34 years old. The primary schools' teachers were slightly older than the colleagues in other school levels. The sample was equally distributed among teaching disciplines: Italian, 38.5%; Mathematics, 37.3%; English 33.7% (multiple responses were allowed). Three quarters of the respondents (72.2%) attended all the three online laboratories; 14.5% just two laboratories, while only 6.8% (n=28) just attended one laboratory (a residual 6.5% is defined by the missing cases). In general, the teachers who attended the online laboratories expressed a high level of satisfaction about the whole training experience. Indeed, in an evaluation scale ranging from a minimum value of 1 to a maximum value of 10 in terms of satisfaction levels, the mean was 7.8 points. There were no significant differences between the different school levels (primary and secondary), or in the teaching disciplines (Italian, Mathematics, English). Regarding the first aspect, there is a slightly greater level of satisfactory by respondents teaching in middle schools (mean value equal to 8.1) and lowest by subjects teaching in secondary schools (7.6). Secondly, there is a slightly higher level of satisfaction by respondents teaching Mathematics in primary and middle schools (mean value equal to, respectively, 8.3 and 8.1). The lowest values are registered referring to respondents teaching at secondary schools (the value is equal to 7.6 for subjects teaching Mathematics and Italian at such school level).

We now wish to analyze in detail some elements of the laboratories, which succeeded in better meeting participants' requirements, and those which, on the contrary, have been judged less effective.

The first dimension refers to the organizational aspects of the laboratories, investigated asking teachers to express their level of satisfaction considering a scale ranging from 1 – minimum satisfaction to 10 – maximum satisfaction. Among the most significant positive elements identified by respondents, are "observance for the timing of the synchronous meetings" and "timing articulation of training days" (mean equal, respectively, to 8.7 and 8.2 points). High satisfaction levels expressed by the trainees were also registered in regard to the "organization of synchronous meetings" and "total duration of the training course" (respectively, 7.9 and 7.8 points). The aspect for which the respondents expressed

a lower level of satisfaction was the "relationship between the discussed topics and the available time" (mean of 7.7). No very significant differences were found for the different school levels (primary and secondary), nor the teaching disciplines (Italian, Mathematics, English), confirming the lowest level of satisfaction by the secondary schools' teachers mentioned above.

In general, teachers gave a positive evaluation on the technological function and effectiveness of the online training platforms. The most positive teachers' judgments were in relation to the platform where the synchronous meetings took place, referring to: its simplicity of use (89.9% of the sample giving a positive evaluation) and suitable access to the platform (89.1%). The information received on the use of the platform on which the synchronous meetings took place was judged "clear" by 83.8% of the respondents. The online platform dedicated to carrying out asynchronous activities (working group activities, delivering of materials and instructions) had the lowest positive evaluation from teachers, although it does not identify particularly critical points. The teachers' positive evaluation scores were:

- suitable access to the platform (64.9%);
- effectiveness of the platform for the delivery of tasks (63.4%);
- effectiveness of the platform for carrying out group work (62.0%).

The information on the use of the platform dedicated to carrying out asynchronous activities was judged to be "clear" by 67.0% of the respondents.

Lastly, more than half of the sample (55.4%) declared that the course engendered new training needs for them; mainly among primary school teachers a significant trend emerged to develop the new training needs (64.3%). In relation to the first two elements referred to the online platform a high share of teachers answered "I don't know", with 20.6% referring to the effectiveness of the platform for the delivery of tasks, 17.2% referring to the effectiveness of the platform for the delivery of tasks and 16.7% referring to the platform's access.

Similarly, new training needs have emerged within subjects teaching Italian (61%) and English (59%), and Mathematics (54%). The new training needs refer to: competence-based teaching approach, didactic-methodological updating on specific disciplines (Italian, Mathematics and English), knowledge of websites / online resources to be used to guide students to pass the Invalsi tests, strategies to better understand the analysis of the Invalsi tests' results, collaborative work modalities between different school levels, analysis of the Invalsi tests to personalize teaching methodologies in order to meet students' needs, practical activities to be implemented in online teaching activities, strategies to stimulate interest of other school colleagues in the Invalsi tests, in order to make them aware of tests' usefulness, improve data literacy competences, strategies to adequately prepare students to be successful in Invalsi tests, specific strategies and tests to be implemented with students with special educational needs.

Discussion

The analysis of data from the questionnaire on teacher experience and expectations shows interesting preliminary data. Firstly, the analysis of the professional development experiences in the previous two years shows the variety of preparation of teachers participating in the training course, with a majority not undertaking any courses on evaluation or improvement. This is evidence that the instruments offered to teachers by the national standardized test are an opportunity that the majority use because many of them know the Invalsi test theoretical framework, particularly at primary level.

In addition, the expectations of the training course expressed by teachers are consistent with its aims to improve the efficacy of the didactical strategies by using Invalsi

data and instruments. The factorial analysis does not indicate two different scales - about the literacy on evaluation and about skill-centred learning strategies. The difference between the two scales is not indicative of the distance between them but the challenge of using the assets produced by large- scale assessment studies on students learning to improve the didactical strategies of teachers.

New training needs emerged after attending the course and several teachers expressed the wish that the training experience should continue, in order to tackle topics that, due to the limited time available, were not been adequately explored during the online laboratories. This highlights the importance of adequate planning of the timing of the training experience, especially when the topics to be covered are complex (as those tackled in the teachers' training course described in this paper). This is confirmed by the fact that one of the least satisfactory elements refers to the "relationship between the discussed topics and the available time".

Another issue refers to the online platform dedicated to carrying out asynchronous activities; the teachers' judgements of the effectiveness of the platform for group work fully illustrate the advantage of the potentialities provided by the Web, matching the training project to the reference target, so as to shape out and structure a virtual learning environment capable of promoting effective cooperation. It is therefore necessary to further investigate which factors facilitate group working activities in an online environment.

Contradicting the frequent charge of "rigidity" levelled against teachers, due to their standardized professional habits and their evaluative strategies of students' learning achievements, the training experience underlines teachers' wishes to improve their data literacy competences. This also implies changing teaching and evaluative methods, with the aim of helping students to improve their learning for a broader improvement of the quality of educational processes.

Generally, the results confirmed the successful outcome of the training course, as evidenced by the high level of satisfaction expressed by survey respondents as well as by their general interest in repeating similar experiences in the future, in order to further tackle some topics that would be helpful for their teaching activities and students' assessment practices.

Conclusion

According to Allulli (2012), in Italian context, the verification of learning is generally reduced to a picture from which, at most, more or less significant comparisons can be made among different schools and geographical areas of the country. However, it does not contribute to the definition of appropriate intervention strategies to improve the school conditions. It is more about quality control than quality development. An evaluation system based only on the assessment of students' learning achievements, like all classic input-output analysis models (Stame, 1998), has a significant weakness: the lack of feedback mechanisms to indicating elements that can orient the system towards improvement.

The key issue refers to how teachers use the standardized tests. As argued by Duru-Bellat (2013), the analysis of data emerging from standardized tests on students' learning achievement should have a heuristic angle, thus serving to identify the areas and dimensions of the school system to be improved.

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