



V Seminar

INVALSI DATA: A TOOL FOR TEACHING AND SCIENTIFIC RESEARCH

February 25th-28th, 2021

ROME

INTRODUCTION

The Seminar "INVALSI data: a tool for teaching and scientific research", now at its fifth edition, has become in recent years an opportunity for meeting and discussion on the use of National Surveys INVALSI results and, in general, on the world of evaluation and school. Evaluation does not only mean standardized monitoring of learning levels, but also evaluation and comparison of its functions and potential in relation to the practices and tools through which the school system is able to carry out its educational and formative mission. This year, keynotes of national and international experts were organized on issues related to the evaluation of the education system and the use of data to support school policies.

One of the objectives of the seminar was to bring the world of scientific research and schools closer together in order to build a privileged and concrete space in which enriching the debate by sharing ideas and experiences between education and research stakeholders. The variety of topics improve a multidisciplinary approach to evaluation in the educational and school field, trying to give an account of the contribution that schools can provide to society by making possible the development of knowledge and skills.

The Seminar is organised by the research group of Area 2 - Statistical Service: Patrizia Falzetti (Manager), Cecilia Bagnarol, Andrea Bendinelli, Leonardo Boulay, Emiliano Campodifiori, Michele Cardone, Silvia Donno, Paola Giangiacomo, Patrizia Giannantoni, Jana Kopecna, Giuseppina Le Rose, Francesca Leggi, Michele Marsili, Monica Papini, Veronica Pastori, Veronica Riccardi, Maria Carmela Russo, Chiara Sacco, Antonio Severoni, Valeria F. Tortora.

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ABSTRACT

THEME 2. LEARNING ANALYTICS FOR IMPROVING THE PERFORMANCE OF STUDENTS AND

INSTITUTIONS: METHODS, EVIDENCE AND PERSPECTIVES

ORGANIZER: POLITECNICO DI MILANO - INVALSI Coordinator: Patrizia Falzetti February 25th: 14.00 - 16.00 {Room Margherita Hack - Research 1}

Some insights on the relationsphip between student performance and test-related emotional aspects Maria Giulia Matteucci - Stefania Mignani - Giada Spaccapanico Proietti

Introduction. The availability of a large amount of data regarding both the student performance and background information, allows studying several aspects that go beyond the simple analysis of the test results and that may lead to interesting research developments, beneficial for the continuous improvement of the evaluation instruments. In a learning analytics perspective, INVALSI makes data available including not only the test responses, but also a set of variables dealing with socio-demographic and economic characteristics, the educational path and, for some grades, student self-reported information about individual and emotional aspects. In the literature, an interesting issue deals with the emotional aspects induced by the test administration. Some studies show how the emotional component may influence the test performance (Putwain and Best, 2012), however, in-depth studies on INVALSI data are still missing (Poliandri et al., 2011). During the INVALSI test administration, students are asked several items about how they experience the test. Students are required to self-evaluation on an ordinal 4-point scale. From the responses, it is possible to compute a scoring expressing the emotional status of the respondents.

Aim and research hypoteses. In this work, we would like to investigate the relationship between the emotional component and the student performance, taking into account the interactions with other background variables, such as socio-demographic (gender, geographical area, nationality), economic, and those more related to the educational path (school type, regular path, etc.).

Data. The analysis is conducted on the Mathematics test data of the scholastic year 2016-2017. The focus is on grade 10, as it represents a very delicate educational step, where the emotional aspects may play a much more decisive role. The analysis may be repeated also on more recent data, when available, for different grades, and with the Italian test data.

Method. Two different approaches, parametric and data-driven, are implemented. The first one is known as latent regression model (De Boeck and Wilson, 2013) and it is based on the idea of simultaneously estimating student ability from the response data and the relationship between the ability and several covariates. Among the independent variables, it is possible to introduce the emotional component previously estimated through a graded item response theory (IRT) model. The second approach involves a supervised method, specifically a regression tree (Breiman et al., 1984), where the dependent variable is the estimated Rasch score and the covariates are the same as in the parametric model. This approach allows to identify groups of students with similar performance, and to highlight how the covariates behave in these groups. In particular, by using a recursive procedure, starting from a group containing all students, at each step sub-groups (nodes) are built so that they are gradually more homogeneous with respect to the dependent variable (the ability, in our example). The partition is done according to a splitting criterion: at each step, a value or category of one covariate is chosen to split the statistical units. The value or category that is able to produce the larger reduction in the variability of the dependent variable in the sub-groups is chosen. At the end of the algorithm, it is possible to obtain a certain number of groups of student with similar performance characteristics. Each group is characterized by specific values or categories of the covariates. The tree allows to improve the knowledge about the variables ruling the phenomenon under study and it allows to establish an hierarchy based on the importance of the variables and to delete those which are not relevant for making the groups. Moreover, this method does not require any assumption about the

statistical distribution of the data, variables can be both quantitative and categorical, and it is possible to deal with large data, both in terms of observations and number of variables.

Results. The tree results may confirm or partially disprove what found with the parametric approach. The main aim of the work is to investigate the effect of the emotional component on the performance from different points of view, by considering both an explanatory interpretation with the latent regression model, and a different interpretation in the classification tree method. The results obtained show that the impact of the emotions on the performance is relevant; in particular, in the latent regression model, the coefficient is significant and highlights a negative impact. The results of the tree confirm this finding showing how, after the school type, the emotional component is the most important covariate. These analyses point out that it is necessary to account for individual aspects in order to obtain a more accurate interpretation of the results on the performance.

Mariagiulia Matteucci, is an Associate Professor at the Department of Statistical Sciences, University of Bologna. Her research interests are item response theory models, Bayesian psychometrics, and educational measurement.

Stefania Mignani, is a Full Professor at the Department of Statistical Sciences, University of Bologna. Her research interests are in the field of latent variable models and statistical methods for social and educational phenomena, with a particular attention to model fit.

Giada Spaccapanico Proietti, is a Research Fellow at the Department of Statistical Sciences, University of Bologna. Her research interests are computational statistics, automated test assembly, computerized adaptive testing.

What does add value? Conceptual and methodological considerations on school value added models Mara Soncin - Tommaso Agasisti - Chiara Masci

School performance estimates have been used worldwide with the aim of guaranteeing school accountability or supporting school choice. Despite the large use of these data, unsolved issues remain about the methodological approach that best matches the nature of data, as well as about the conceptual discussion of what the school value added represents. The current research starts from these premises by exploiting the administrative datasets provided by INVALSI (National Evaluation Institute for Education) on lower secondary schools in Italy in the school year 2018-19. The availability of a broad set of individual, class and school-level characteristics makes it possible to sort out the impact of other factors and to focus on the school value-added between the last year of primary school (Grade 5) and the last year of lower secondary school (Grade 8). The contribution of the paper is twofold. First, we test the stability of valueadded measures across different specifications by means of sophisticated statistical models that assess to what extent the estimates vary depending on the model selected. In this way, we base our estimates on the use of multilevel models, both parametric and non-parametric, to take into proper consideration the nested nature of data. By assuming this approach, we also define alternative levels of nesting and we investigate how the school effects vary accordingly. We go deep in the data hierarchy, considering class, school and geographical regions as potential grouping factors. As a result, we observe that the regional grouping explains a large proportion of unexplained variance in student performance, which is at least comparable or even larger than the one explained by the school grouping. Moreover, we observe a large positive correlation across school value added estimates obtained in models regardless their specification, even though non-parametric models report slightly higher model performance. Results underline the importance of disentangling the effects attributable to different levels of grouping, in the perspective of identifying the effect of each level, net of all the other ones. Second, we propose a discussion on the variables that should be included in a model estimating the school value added. This consideration moves from the definition of school value added itself, which is here intended as what the school "adds" to student achievement net of any personal or contextual characteristics. In such a definition, the set of variables included in the model is relevant in influencing the school effect, and as such it needs careful consideration. For this reason, we

compare models including different clusters of variables and we propose a two-stage approach to estimate and explore the school value added, a posteriori. At first stage, we estimate the school effect by means of the aforementioned statistical models. Then, we run a second stage model in which the school effect is regressed against a set of covariates that fall in the realm of the factors influenced by school principals' decisions. In detail, in the first stage, we adjust the school value added estimates for those school characteristics that do not depend on the school principal's practices and decisions. In the second stage, we include variables related to the class size and to the class composition, like an index of between classes sorting within school, in order to test whether these factors influence the school effect. In this respect, we also contribute to the conceptual debate about what variables should be included in a model that estimates the school value added and what other factors should be instead used to explain the estimated value added. Finally, methodological and policy implications about the specification of value-added models and their use are provided.

Mara Soncin, is Junior Assistant Professor at Politecnico di Milano, School of Management. Her research interests are in the educational field, with a focus on (i) digital learning, (ii) school management and (iii) the use of quantitative models for the evaluation of public policies.

Tommaso Agasisti, is Professor at Politecnico di Milano, School of Management and Associate Dean for Internationalization, Quality and Services at MIP Politecnico di Milano Graduate School of Business. His studies are in the field of Public Economics and Finance, Public Management and Policy, Public Administration, with particular reference to the educational sector.

Chiara Masci, is Junior Assistant Professor at Politecnico di Milano, Department of Mathematics, in the statistical branch. Her research interests are in the development of innovative statistical methods in the area of mixed-effects regression and classification models, both parametric and nonparametric, and in their application in the educational field.

The influence of non-effortful students behaviour on the school perfomance Chiara Sacco

Literature. National Institute for the Evaluation of the System of Education and Training (INVALSI) conducts annually large-scale survey assessments to monitor students' skills in Italian Language, Mathematical knowledge and English Language. A topic of great interest is the students' test-taking behaviour during survey assessments. Of particular interest is the impact of unmotivated test taking on test performance: without sufficient effort it is difficult to explain the impact that absence of motivation and/or inadequate knowledge have on a poor test score. The key idea is that students' score does not reflect only what the student know and can do but also depends on his/her test-taking effort affecting the validity of the resulting test score. Several researchers shown that low effort tend to bias student test score downward (Wise and DeMars, 2005; Rios et al., 2017). It has been shown that test-takers typically show less motivation in lowstakes tests than in high-stakes tests, since they perceive few or none consequences of their performance on that test. A central research topic is the implications of low test-taking effort on students' outcome since the test results are used to evaluate the school performance and to monitor the school system. From the analysis of TIMSS data it has been shown that students, in general, did not seem very motivated to do their best on the low-stakes test and the findings of the analyses at country level suggest that motivation has actually an effect on performance and on the differences between countries (Eklof et al., 2014). Setzer et al. (2013) found relevant changes in the rank school ordering after removed students clearly unmotivated. On the other hand, Jensen et al. (2018) demonstrated that the presence of non-effort responses has a minimal influence on the teacher value-added estimates.

Objective and Research Hypotheses. The diffusion of computer based tests has opened the way to new measures of the student effort: thus far, it has been shown that the response time at item-level (i.e., the time spent by each student on a single item) is a good indicator of student engagement. The aim of this study is to examine the prevalence of non-effortful behaviour to determine if this behaviour varies by grade, subject,

and school, and to evaluate if and how the non-effortful behaviour of the students during the INVALSI tests influenced the school performance in terms of test scores and the value-added estimates.

Data. In 2018, INVALSI moved from paper-and-pencil to computer-based tests (CBT) which were administrated for the first time at the students at the 8th Grade (last year of the lower secondary school) and at the 10th Grade (second year of the higher secondary school). In this framework, for the CBT, the following set of variables, in addition to the student answer, are currently collected for each item: the response time, the total time spent on the item by the student, and the number of attempts, the number of times that the item has been viewed by the student. In this work, the response time for each item of the INVALSI tests in Italian Language and Mathematics, administrated in the school year 2017-2018 at the 8th Grade and at the 10th Grade, has been exploited to measure the student effort.

Methods. To assess the student effort on the INVALSI test, the indicator of Response Behaviour Effort (RBE), proposed by Wise and Gao (2017), has been computed for each student. The variation of the RBE score across schools has been estimated using the intraclass correlation. It is a common practice to consider a RBE equal to 0.90 as a useful criterion for invalidating a score since it has been shown that if the percentage of non-effortful response exceeds the 10% the test score is too distorted to be trustworthy (Wise, 2015; Wise and Kingsbury, 2016). Based on this criterion the behaviour of a single student has been classified as non-effortful if the RBE is minor or equal to 0.90 and a motivation filtering procedure, the removal of the non-effortful students, has been applied. The school's performance in term of mean score and value-added has been analysed pre and post the motivation filtering procedure and the impact of non-effortful behaviours on school performance has been studied.

Results and Discussion. The findings of this work could be an important instrument to understand the impact of non-effortful behaviour on INVALSI tests which are usually considered as benchmark from policymakers and educators for planning educational reforms and interventions. Moreover, this study could rise the question of how increases student's motivation, comparing the results of the Grade 8 students and Grade 10 students. Indeed, the INVALSI test at Grade 8 are considered as high-stakes test, since the tests are compulsory for the student admission to the state final exam and INVALSI releases a certificate to each student to attest the competence level, whereas the Grade 10 tests are low-stakes.

Chiara Sacco, PhD in Statistical Methodology for Scientific Research, currently works at the INVALSI Research Institute as statistician. The main research interests are in the context of multivariate data analysis for high dimensional data with particular focus on dimension reduction strategies, model based clustering and latent variable models.

THEME 3. INVALSI DATA: A TOOL FOR IMPROVING TEACHING AND FOR EVALUATING

TRANSVERSAL SKILLS Organizer: INVALSI Coordinator: Ellen Claes February 25th: 14.00 - 16.00 {Room Carlo M. Cipolla – Research 2}

The orthographic competence in the INVALSI tests Maria G. Lo Duca - Zuzana Toth

The present study examines the orthographic tasks administered within the section dedicated to reflection on language of the INVALSI tests, starting from the first years when the tests were administered up to 2019. The study aims to deepen our understanding of 1) what kind of orthographic strategies (phonological, lexical, morphosyntactic) are activated by the tasks; 2) if the tasks are equally distributed between school levels and levels of difficulty; 3) if the test results allow for the identification of a progression of topics, from the easiest to the most difficult. The identification of such progression would make it possible to outline a vertical grammatical syllabus, to guide the selection of topics to focus on at various school levels and the formulation of tasks in the INVALSI tests. A first analysis of the questions reveals that the majority of them activate a lexical or a morphosyntactic strategy. It is problematic to locate these questions along a continuum of difficulty for two reasons: 1) their difficulty is influenced by multiple factors; 2) the available tasks do not cover all levels of difficulty at every school type. Nevertheless, the main difficulties seem to originate from two sources: 1) in tasks that activate a lexical strategy, in which students are requested to selects between different graphemes representing the same phoneme, major difficulties arise when the words in question are not frequent in students' linguistic experience; 2) tasks that activate a morphosyntactic strategy are more difficult if they require a formal analysis of the linguistic context that is not supported by semantics, and explicit knowledge about grammar.

Maria G. Lo Duca, after having taught for 20 years at a lower secondary school and a liceo scientifico [upper secondary school] in Padova, became full professor of 'Italian language' and 'Didactic of Italian' at the University of Padova, where she was the director of the Master School Didactics of Italian as L2, and also taught at the Specialisation School for teachers SISS (Scuola Interateneo di Specializzazione per l'insegnamento) during its whole period of existence. Her research focuses on linguistics and didactics of Italian as first and second language. She also collaborates with Accademia delle Crusca and INVALSI. She is the author of books and papers dedicated to the description of Italian, its acquisition, its teaching. *Zuzana Toth,* is research fellow at INVALSI. Her research focuses on the development of linguistic competence and language awareness in L1, L2 and L3(s).

MEL Model for Literacy Education: Teacher education and professional development in literacy teaching Tiziana Mascia

Introduction. Reading skills progress achieved by Italian students in the fourth year of primary school (INVALSI, 2012) decreases in the assessments of 15-year-old students. Italy's score in the PISA survey is eight points below the OECD average. In the ranking of OECD countries that participated in PIRLS 2016 Italy was ranked tenth and dropped to the twenty-second position in PISA 2015 (INVALSI, 2016). The evident impact on these results, which persists from previous surveys, is the competence gap among students from the North and the South of Italy. According to the PISA 2015 survey, almost one out of two 15-year-old students (47%) does not reach the minimum level of reading ability and comes from the most disadvantaged socio-economic background, eight times more than a peer growing up in a more wealthy family (6%) (Save the Children, 2017). OECD PISA 2015 studies also reveal that "in our country, the number of resilient students, those who come from disadvantaged backgrounds and manage to achieve positive

results in PISA tests, is limited to 20.4%" (Agasisti et al., 2018). "Fifty years after the publication of the book Letter to a Teacher, every single study continues to show the impact of family status on students' achievements and, ultimately, on their actual ability to exercising the rights attached to their citizenship and succeeding in life" (Save the Children, 2017, pp. 248-249). Literacy is not just a concern for children. The international PIAAC survey assesses how almost the 70% of Italians people aged 16 to 65 doesn't reach the level 3 of literacy skills (ISFOL, 2014). These results suggested to Tullio De Mauro some important actions to be taken to improve the Italian situation (ISFOL, 2014). First of all, more schooling and more cross competences, such as literacy skills. The EU High Level Group of Experts on Literacy (EU High Level Group of Experts on Literacy, 2012) had already been moving in this direction in 2012, pointing out to all EU countries the importance of focusing on certain areas in order to improve literacy skills and reading motivation: among these areas there was the quality of literacy teaching in schools which requires in-depth and specialized competences. Research questions, hypotheses and objectives. Despite this educational emergency, no specific initial teacher education and professional development in literacy teaching and learning is provided (Balbinot, Cunha, Garbe, Lafontaine, Diónisio, Shiel, Tamburlini, and Valtin, 2016), and there are limited empirical studies combining teachers' competences on teaching reading. In the Italian school the position of reading specialist is not included (Eurydice, 2011), as provided for in other European countries. What skills should teachers be expected to achieve in a training course on literacy? And what are the effects of training teachers on didactics? The purpose of the research is to provide answers to these questions and to develop a Model for Literacy Education (MEL) that can be applied, with positive impact, in continuous education and as an element of professional development for teachers in Italy.

Data analysis. Secondary data analysis of ISTAT national surveys on the number readers (ISTAT, 1958; 1966; 2017; 2018) and international surveys on reading literacy competences IEA PIRLS, OECD PISA and OECD PIAAC (Isfol, 2014; Miller and McKenna, 2016; Mullis et al., 2012; 2015; 2017a; 2017b; 2017c; OECD, 2003; 2010a; 2010b; 2010c; 2013a; 2013b; 2016; 2017a; 2017b; 2018). The aim is to describe the state of the art of literacy in Italy and to identify the main issues affecting reading education, also through an international comparisons. Theoretical framework on the developing process of reading skills and competences from pre-school to adolescence education. Data resulting from the quantitative and qualitative survey of the pilot project which involved a sample of teachers and students from two schools located in areas defined as "at risk and with a high migratory impact" in Northern and Southern Italy.

Methodology. The described context illustrates the composite nature of this research in the scientific field of literacy pedagogy and didactics, which is developed on different levels and stages of analysis. For the organisation of the research data and the definition of the Model for Literacy Education, it has been adopted the methodology of mixed methods integrating the quantitative and qualitative approach (Amaturo and Punziano, 2016).

Outcomes. Definition of MEL: Literacy Education Model for specific initial teacher education and professional development in literacy teaching, so that teachers are able to acquire the necessary knowledge to supporting students' long-term reading development. MEL model includes 15 guidelines for the pre-school and primary school education, which summarise the theoretical references and best practices to develop each competence linked to literacy. A pilot project was conducted with the collaboration of the Italian Centre for the Book and Reading (MIBACT) in order to assess the outcomes of implementation of the MEL program.

Tiziana Mascia, is doctoral researcher in General Pedagogy, Social Pedagogy and General Didactics at the Faculty of Education of the Free University of Bozen-Bolzano. Here she conducts research on pedagogy and on the didactics of literacy, digital literacy and the development of distance education programs on literacy. She is the author of essays on literacy education and of the Rai Cultura programs "Invito alla lettura".

The achievements in INVALSI National Surveys of students who have followed educational experimentations Stefano Scippo

Introduction. The present paper proposes a method to isolate as much as possible the effects of different educational experimentations in Italy on learning outcomes measured by the INVALSI National Surveys, to contribute to the debate on the effectiveness of such approaches, such as Montessori, SenzaZaino, Waldorf, libertarian schools, DADA. To illustrate the proposal, let us take as an example the research being carried out, in the framework of the Doctorate in Social Psychology, Development and Educational Research, at the Sapienza University of Rome, on Montessori teaching. Montessori pedagogy is an applied international reality, with fairly defined standards, in more than 30 countries, and there is a corpus of empirical research on the learning outcomes of Montessori students carried out mainly in the USA, research of which Marshall (2017), in a recent review, identifies the following recurring limits. 1. Few longitudinal studies. 2. Lack of randomization. 3. The effects of the specific Montessori education practices are not isolated. 4. It is not taken into account more than one school/class. 5. The effect of Montessori orthodoxy is not isolated (eg specialized teachers or accredited by a professional organization). 6. It is not taken into account how many years of Montessori education the members of the experimental group received. 7. Low socio-economic-cultural variability within the experimental group.

Research subject and hypothesis. The use of the INVALSI data of the National Surveys makes it possible to overcome most of the aforementioned limits and to compare the tests results of the National Surveys of students who attended the Montessori nursery and primary school with the results of they did not attend this type of school in the first years of life. The hypothesis to be tested is the existence of a statistically significant difference between the average of the scores in the Italian language and Mathematics tests' scores in Grades 2, 5, 8 and 10 of Montessori and not-Montessori students. The verification will be carried out with univariate ANOVA with a single factor between subjects, with post hoc comparisons. In the event that one of the distributions of the scores in the two samples is significantly different from the normal distribution (according to the Shapiro-Wilk test), then outliers will be identified and excluded.

Used data. The necessary data are about the background and result variables of the entire population participating in the following National Surveys: • 2012-13, Grades 2 and 5; • 2015-16, Grades 5 and 8; • 2017-18, Grade 10; • 2018-19, Grade 8.

Method. It's a quasi-experimental design with only post-test and control group (Campbell, 1990), to be identified with the method of simple matching (precision control), that means «to find matching pairs of identical subjects and place one of the pair in the experimental group and the other in the control group. Obviously, it is not sufficient to match the two subjects on a single characteristic. They must be matched on all relevant characteristics simultaneously» (Bailey, 1995). The relevant characteristics are all the variables that INVALSI considers to calculate the added value, plus the school variable (otherwise institute, otherwise province, otherwise region, otherwise geographical area), in the comparison between level 2 and level 5 achievements, and the following variables in the comparison between grades 8 and 10 achievements: total score at grade 5 tests and class (otherwise school, otherwise institution, otherwise province, otherwise region, otherwise school, otherwise institution, otherwise province, otherwise region, otherwise school, otherwise institution, otherwise province, otherwise region, otherwise school otherwise institution, otherwise province, otherwise region, otherwise geographical area). To explore the possible effects of the variability of the dependent variable, in addition to the reconstruction of the previous career of an experimental subgroup, an on-line questionnaire will be administered to the teachers of the students of the experimental group.

Results. It has currently been reconstructed that, in 2012-13, there were 50 Montessori fifth Grade classes in Italy, for an estimated total of about 920 students and, in 2015-16, 51 classes for about 990 students. At the moment, we tracked the careers of - 438 students who were in the fifth Grade of Montessori school in 2012-13: 51.83% of them attended 6-8 years of Montessori school, 40.41% attended 4-5 years, 7, 96% attended 1-3 years; - 485 students who were in the fifth class of Montessori primary school in 2012-13: 44.33% of them attended 6-8 years of Montessori school, 45.98% attended 4-5 years, 9.96% attended 1-3 years. At least 4 years of Montessori school are considered Montessori student, because in Italy there are more Montessori preschools (Children's Houses) than primary schools, therefore it is possible that in the control group there are students who have attended a Children's House, and it is not possible to identify them with this method. However, the percentage of Montessori preschools in Italy is so low out of the total

of Italian preschools that is negligible the probability that their students will be assigned to the control group with the simple standardization method. Regarding the group of 2012-13 whose career has not been tracked, it can be assumed, generalizing the data of the sub-group, that they have attended, with more than 90% of probability, at least 4 years of Montessori school. As regard the experimental group of the cohort that was in fifth grade in 2015-16, it is not necessary to make this assumption because INVALSI can trace all those who participated in both the 2013 surveys on Grade 2 and the 2016 surveys on Grade 5, therefore all those will surely have attended a Montessori school for at least 4 years.

Stefano Scippo, PhD student in Developmental Psychology and Educational Research at Sapienza, he is a trainer and a Montessori teacher. He has 2 pedagogical degrees, 2 specializations and 4 years of experience abroad. He worked in linguistic-pedagogical research for universities and other institutions. Currently engaged as researcher on STEM education for ESA.

THEME 4. STUDENT RESULTS AND THEIR CHARACTERISTICS Organizer: INVALSI Coordinator: Giovanni Abbiati February 25th: 14.00-16.00 {Room Margherita Beloch Piazzolla - Research 3}

Digital and informative skills: the differences between students and the role of the school Ornella Papa - Rita Marzoli - Sara Manganelli

Introduction. Computer and information skills are not very widespread among Italian students and not adequately developed in schools; this is what the International Association for the Evaluation of Educational Achievement (IEA) ICILS (International Computer and Information Literacy Study) revealed and in which Italy participated for the 2018 edition (Fraillon et al., 2020). In the ICILS survey Computer and Information Literacy (CIL) is defined as an individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in society (Fraillon, 2013); the structure of the CIL construct is articulated in four strands that frame the skills and knowledge: understanding computer use, gathering information, producing information, and digital communication (Fraillon et al., 2019). The ICILS 2018 survey, conducted on students at the eighth Grade, involved 14 countries in 4 continents revealing a generally critical situation, particularly for Italy among European countries (Fraillon et al., 2020).

Object and research hypothesis. This contribution focuses on the digital and information skills of Italian students, analysed as part of the ICILS 2018 project. In particular, student results are studied in relation to: 1) students' characteristics such as gender, migratory origin and socio-economic-cultural background; 2) activities that contribute to developing students' digital and information skills. The hypothesis investigated is that the data converge to reveal the useful and necessary inclusion in the school of computer information literacy. The growing importance that these skills have for active participation in public life has been emphasized by the changes resulting from the Covid-19 pandemic. The results of the study provide valuable information to support the development of CIL in the Italian school, in order to promote social inclusion.

Data. The data analysed in this study are national data collected by INVALSI in collaboration with the IEA, as part of the ICILS 2018 project. The focus is on the results of the CIL test and on the information collected through the student questionnaire. The Italian sample includes 2810 13-year-olds students attending the eighth year of schooling; 20 students were randomly extracted from every sampled school - whose probability of sampling was proportional to the size of the institution (sampling probability proportional to size). In Italy the administration took place at the beginning of school year unlike in the other countries.

Method. The analyses are conducted using the variables and indices available in the international database limited to Italian data, information relating to students and the estimated plausible values for the CIL, applying the appropriate sampling weights.

Results. The Italian students' results, in line with the international ones, show that the students do not possess sophisticated digital skills - although they are digital natives - and that the mere presence of computer equipment at school is not sufficient to develop digital and information skills. The characteristics of students such as gender, origin and socio-economic-cultural background, analysed in relation to the CIL, also confirm the differences found at the international level (Fraillon et al., 2020). Italian female students perform better than their male peers; immigrant students, more generally students who speak at home a different language than the test language, perform worse than other students. The major differences are related to the socio-economic-cultural background of the students, i.e. their parents' level of education and profession. In this context, the presence of learning resources at home, including the number of computers and internet access, is also relevant. However, students achieve better results if they use the computer for schoolwork and if they have learned the necessary skills in the school environment. These results support the role of schools in the development of CIL and overcoming differences, suggesting the need for digital and information literacy to be integrated into the school curriculum, in parallel to digitization. A decisive contribution could come from innovative school libraries, recognized under the PNSD (National Digital School Plan, Law 107/2015) as a privileged place to surmount all forms of disadvantage, including the digital divide. The historical link between library and information literacy is

recalled by the achievement of the best ICILS results in Denmark, a country where school libraries are compulsory in all schools.

Ornella Papa, is a specialist in Psychological Evaluation, psychotherapist and researcher at the INVALSI Library. She dealt with the OECD PISA Projects, Evaluation and Improvement, INVALSI Tests about Special Educational Needs. She deepened the role of School Libraries for student achievement and developing information literacy. **Rita Marzoli**, is director of INVALSI Library; she graduated from the Vatican School of Librarianship. She is editorial board coordinator for 'INVALSI per la ricerca', a double-blind peer-reviewed series published by Franco Angeli. Her research interests are: systematic review, bibliometrics, open access, research evaluation, information literacy.

Sara Manganelli, Phd, is a researcher at INVALSI. She has worked in IEA PIRLS, TIMSS, ICCS international comparative surveys, and in national projects about school evaluation. She has conducted several studies for developing psychometric instruments and analysing large-scale datasets with multilevel techniques and structural equation modelling.

Perceived self-efficacy and use of new technologies: the personalization of learning for the improvement of the didactical strategies Sara Mori - Alessia Rosa - Daniela Bagattini - Jessica Niewint-Gori

Introduction. The emergency of Covid-19 has forced schools to rethink the physical and digital space for learning and taking full advantage of the opportunity of technologies in reorganizing the time of teaching. The innovation of teaching and the change of the traditional model of learning processes is a debated topic even before the pandemic (Oliva and Petrolino, 2019; Indellicato, 2019). In many cases schools were unprepared to face the complexity of remote teaching; some of them, however, have managed to maximize their resources due to the didactic practices applied before the pandemic. The differences between territories and schools, which was even more evident in the pandemic, as also reported by the Censis report (2020), highlights the need for a rethinking and transformation of school (Luperini and Puccetti, 2020). This research aims to analyse the students' perception of the use of technologies and as a tool for supporting teachers in the use of technologies to improve personalized learning. The concept of personalization of learning (Mincu, 2012; Giampaolo, 2017) includes the set of didactic strategies aimed at guaranteeing to each student their own form of cognitive excellence, through the elective possibilities of cultivating their own intellectual potential (marked capacity compared to others). In this sense, these learning paths can be configured as transferable good practices, in order to facilitate overcoming the gaps that exist today.

Research subject and hypothesis. The aim of this research is to investigate the role of new technologies in the process of personalization of learning. The study was conducted in the context of a high level use of new technologies in teaching, even before the Covid-19 emergency. This research includes the students' perception of different orders and grades emphasizing the perception of the change in the student's ability to use new technologies for learning and in their spare time. This study also aims to investigate a high-tech middle school and the given potential for teachers to personalize the courses to improve inclusion and overcoming gaps. It is hypothesized that starting in a high-tech context, students will perceive themselves as more autonomous and have a wider sense of self-efficacy. At the same time, teachers are thought to be able to maximize personalization paths thanks to the facilitating context of technological support. This research will also investigate the change in students' perceptions of the support of technologies in the process.

Data used. This research reported on data from an online survey completed by students of primary, middle and high schools. In particular, it will report about a case study of the "Ercole Marelli" a middle school of Sesto San Giovanni (MI) connecting the school's ESCS data and average results in the INVALSI tests and dispersion index. Methods. The project makes use of the potential of research-training models (Magnoler, 2012; Asquini, 2018), which have the advantage of actively involving the stakeholders reflecting on the implemented practices. It includes the students' perceptions in three different contexts: the "Ercole Marelli" Middle school of Sesto San Giovanni (MI) (387 respondents); the students involved in the experimentation of robotics of the Pon Coding and Robotics project (197 respondents) and a voluntary compilation, through INDIRE's online channels (349), for a

total of 933 students. The actual research will be carried by the teachers of the "Ercole Marelli" Middle School of Sesto San Giovani (MI) which has a long tradition in the use of technologies. The research is aimed to support teachers in the use of technologies to support the process of personalization in the learning of their students. Expected results. Overall, 680 students of middle schools completed the online survey, and 57% are students of the school that took part in the case study of this contribution. From a first analysis of the survey, more than half of the students of this school declared to have carried out more than 15 hours a week of distance learning, a higher percentage than the rest of the participants. 48% of them also declared that all their classmates attended the lessons, compared to a much lower percentage for the other two groups of students from other schools. The students of San Giovanni are also the group with a higher percentage of perceived autonomy in terms of requesting help (47% say they did not need it). This paper intends to investigate the differences between the different groups of students and conduct an in-depth study of the school of San Giovanni.

Sara Mori, is a Technician at INDIRE; she is a researcher and lecturer at the IUL. Her main research interests are the evaluation and improvement of school innovation processes and the development of transversal skills.

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Gender difference in financial literacy and socialization: comparing Italy to Spain Emanuela Emilia Rinaldi - Luca Salmieri - Joaquin Vera Moros

Introduction. Italy is one of the seven countries that participated in all three financial literacy PISA assessments conducted in 2012, 2015 and 2018, together with Spain. Based on the mean score of 15-year-old students on the last PISA assessment of financial literacy skills (INVALSI-OECD, 2020), Italy occupies the lowest position, eleventh among OECD countries, while Spain the nineth. Yet, Italy highlights, since 2012, a significant gender difference in financial literacy (boys performed better than girls) while in Spain this is not the case (Instituto Nacional de Evaluación Educativa 2020; OECD, 2020a). This gender gap in Italy has been found among teenagers (OECD, 2014a, 2017, 2020b), adults (OECD, 2020b), but not among preadolescents (Rinaldi and Todesco, 2012). In Spain, among adults (Banco de España, 2017). However, few studies to date have attempted to explain why women are less financially literate than men and why this gap appears only at a certain age (ex.: Fonseca et al., 2012; Cupák et al., 2018; Longobardi et al., 2018).

Object and research hypothesis. The paper focuses on finding possible factors explaining the gender gap in financial literacy in Italy adopting a comparing perspective (ex.: Cordero et al., 2019; De Beckker et al., 2020) between Italy and Spain. The hypothesis is that families, welfare state, media and financial education policies play different roles in the two Countries, that eventually shape financial socialization patterns more gender neutral. Used data. We used data from the last OECD-PISA financial literacy survey comparing Italy to Spain. In Italy, the sample was made up of 9,122 students aged 15, while in Spain it was made up of 4,100 students of the same age. Methods. In order to find possible factors explaining the gender gap in Italy, and the lack of it in Spain, we used three different methods. First, we run an extensive literature review on papers on gender gap in financial literacy in Italy and in Spain, both among adolescents and adults. Then, we interviewed opinion leaders (with semi-structured interview online or by telephone) who carried out researches or projects on financial education in Italy (4 experts) and Spain (4 experts). Then, we used the OECD PISA 2018 financial literacy data from Italy and from Spain to compare the financial socialization patterns in the two countries. We focussed the analysis on these variables, related to gender differences: self-confidence in financial matters; importance given to money (as a proxy to materialism); sources of financial information; parental implication in financial matters; financial autonomy. We run a multivariate linear regression and then a multivariate log regression in order to calculate the

odd ratios and find out which of these variables are more relevant over financial literacy performance in the two countries.

Results. Our paper confirms previous studies and suggests that the socio-demographic characteristics of students' family, students' Math literacy, and mother as financial socialization agent play a significant role in shaping the gender gap in Italy, more than in Spain. Furthermore, it suggests that more variables should be taken into consideration in future surveys, gathering richer details on materialism, parent's role models, gendered values and norms and self confidence in financial issues. Research more focussed on gender differences in behaviours and attitudes, rather than knowledge, related to financial literacy may help improve understanding the development (or reduction) of gender gap.

Emanuela E. Rinaldi, PhD, works as Assistant Professor in Sociology of cultural and communication processes at the University of Milano-Bicocca. She is the scientific director of ONEEF (National Observatory of Financial and Economic Education) and member of the Board of RN10 education of the European Sociological Association. *Luca Salmieri,* is Associate Professor at Sapienza, University of Rome where he teaches Sociology and Culture and member of the editorial boards of the journals International Review of Sociology and Scuola Democratica. He published on Cultural Studies and carried out research on youth, education, learning, and transition to adult life. *Joaquin Vera Moros*, Agricultural Engineer, Polytechnic University of Madrid. Teacher with tenure, Spanish Vocational Education and Training. He currently works at the National Institute for Educational Assessment, Spanish Ministry of Education, as Head of Unit at the Data Analysis Department and he is National Data Manager for the Programme for International Student Assessment (PISA).

Tackling the gender gap in Mathematics with active learning and teaching practices Daniela Piazzalunga e co-autrici

Introduction. International assessments of children's skills show that the gender gap in Mathematics (GGM) largely varies among countries. Among 15 years old children, PISA data for OECD countries show that the average gender gap in Mathematics (girls minus boys) varies between minus 16 for Italy and plus 10 for Iceland, with an average equal to minus 5 points (OECD 2019). Given that girls do better than boys in most academic outcomes, we may question whether the girls' disadvantage in Math should be viewed as a policy-relevant issue. Although differences in preferences and labour market expectations are important determinants of the choice of the field of study in college, the females' relative weakness in Math is also one of the reasons for the critically low share of women in STEM disciplines at university and of women's underrepresented in high-paying occupations, with effects on gender differences in wages and wealth (Card and Payne, 2017; Paglin and Rufolo, 1990; Machin and Puhani, 2003; Black et al., 2008; Piazzalunga, 2018; European Commission, 2015; National Academy of Science, 2007; Sierminska et al., 2019; Turner and Bowen, 1999). In addition, recent research underlines the importance of mathematical skills also in non-STEM degrees and occupations (Grinis, 2019; Delaney and Devereux, 2020). A wide range of theories has been proposed for the existence of the gender gap in Mathematics. While some scholars refer to biological differences in brain functioning (e.g. Baron-Cohen, 2003), recent research questions such interpretation. Moreover, the high variability of the gender gap in Math across countries points to cultural and societal factors. First, in countries with higher gender equality, girls perform better than boys in Mathematics (Guiso et al., 2008; Pope and Syndor, 2010; Nollenberger et al., 2016; Gevrek et al., 2018). Second, parents' and teachers' attitudes and stereotypes about girls and Mathematics influence the gender gap in Math (Ertl et al., 2017; Carlana, 2019; Dossi et al., 2019). A less explored potentially relevant factor refers to educational methods and practices. Some studies suggest that when Mathematics' teaching is centered upon problem-solving, involving students in discussions and investigative work, the gender gap decreases and can even disappear (Boaler and Greeno, 2000; Boaler, 2002; Zohar and Sela, 2003; Boaler, 2009; OECD, 2016).

Object and research hypothesis. In this project, we design a teaching method grounded on the "Mathematics Laboratory" (Anichini et al., 2004), based on group and peer work, sharing and comparison of ideas, class discussions led by the teacher, "doing" instead of "listening" through problem posing and problem-solving. The hypothesis is that by empowering children with a "growth mindset" (Boaler, 2013), by eliminating competitiveness and by valuing mistakes as learning opportunities, this methodology could contribute to

reducing the gender gap in Mathematics. Our main research question is thus whether the program can help to reduce the gender gap in Mathematics.

Data used. For the project, we use ad hoc designed tests on Math numeracy and INVALSI data. All children sat a pre-test and a post-test on Math numeracy. The tests were designed by the scholars of Mathematics education members of the research team and followed the same conceptual framework of the INVALSI assessment. They consist of 13 questions and 20 items each, to be completed in 40 minutes. The reasons for using tests designed ad hoc is two-fold: first, INVALSI assessments cover also other domains and have a lower number of items on numeracy only (around 15) than our test; most importantly, the INVALSI assessment is only available for other Grades, with a level of difficulty not appropriate to Grade 3. INVALSI data are used to compare the participating classes with schools in Piedmont and in Italy overall, in terms of scores in Math and Italian language at the assessment in Grade 2 and socio-economic background.

Method. We design an innovative teaching method and evaluate the causal impact of the intervention with a randomized controlled trial (RCT). The trial takes place in the province of Torino, involving 50 third Grade classes in 25 schools, and 1,044 students. Each school participates with two classes, one assigned to the treatment and one to the control group. The treatment is delivered at the class level and it is carried out by tutors trained in Mathematics education as a substitute to the traditional Math hours, while teachers were present in the classroom with the role of observers. Children in control classes follow the usual curriculum with their own teachers.

Results. The treatment significantly improves Math performance for girls (0.15 s.d.). In educational studies, this effect can be considered large in magnitude and policy-relevant. In addition, we find that girls with high pre-test scores benefit the most, while there is no effect for boys. Overall, the intervention contributes to reducing the gender gap in Math by 39.5-46.2% The results indicate that properly designed innovative methodologies have the potential to reduce the gender gap in Math and call for further research on the role of teaching practices on Math learning.

Daniela Piazzalunga, is researcher in Economics at FBK-IRVAPP (Research Institute for the Evaluation of Public Policies) and research Affiliate at CHILD Collegio Carlo Alberto and IZA. Her research interests include human capital development, gender economics, and labour economics more broadly, with a focus on policy evaluation methods.

THEME 6. INVALSI DATA AS A TOOL TO SUPPORT INNOVATION AND SCHOOL IMPROVEMENT Organizer: INVALSI Coordinator: Agostino Portera February 25th: 17.15-19.30 {Room Manlio Rossi-Doria - Research 4}

Profiling schools according to tests' data use: Identifying enabling factors and levers of change Giulia Montefiore - Gerard Ferrer-Esteban

Introduction. The National Evaluation System (SNV) puts the continuous improvement of schools, in addition to school accountability, as the final objective of self- and external evaluation, with an important role of the INVALSI national assessment-tests. The interpretation and analysis of the tests' results, together with other information, should lead schools to enact improvement processes, both in organizational and instructional terms (Castoldi, 2014). International literature on data use identifies factors deemed essential for an effective use of data, such as school institutionalized routines for data use, access to data, time available for analysis, teacher collaboration norms and leadership for data use, with clear objectives and that drive towards data use (Coburn and Turner, 2011). These enabling factors, if absent, can turn into barriers hindering change and improvement processes (Schildkamp et al., 2014). In addition, these individual and organizational aspects can interact with the accountability system, which acts as a moderator of modes and intensity of data use (Jennings, 2012). In Italy, Pastore and Freddano (2017), Di Cresce (2019), and Pastori and Pagani (2016) report increasing trust in the validity of INVALSI data but, at the same time, widespread difficulties in making use of it by discussing and constructing implications for school practices, due to the absence of the factors already mentioned. According to Falzetti and Giangiacomo (2015), tests' results are communicated and discussed with teachers, but it is less common for this to happen with families or their representatives. It emerges the need to analyse the schools' organizational characteristics in relation to how they use the results of the INVALSI tests.

Research object and hypotheses. The objective of the research is to investigate the crucial factors for the use, on the part of schools, of data from INVALSI tests, specifically for school improvement. The research also aims at identifying the relationships between these elements and highlighting the factors that can be object of leverage for more use of data. It is first hypothesized that INVALSI results are used for improvement especially where principals have positive opinions and attitudes toward INVALSI tests and use. In addition, it is hypothesized that principals' positive attitudes are translated into data use for school improvement especially when principals frequently organize moments of collaboration and sharing among teachers. The presence of distributed leadership in the school will play a crucial role, translating into diffused responsibility among teachers for management and organization. It is also hypothesized that strong instructional leadership, if associated with administrative leadership, can play an important role for INVALSI data use for school improvement.

Data used. The research uses the results of the 2018-2019 Principal Questionnaire and Teacher Questionnaire, together with data on school characteristics and test results available through INVALSI. Results of previous editions have also been used in order to observe time patterns in data use. Method The first empirical approach concerns the profiling of schools based on a 'multivariate cluster analysis', in which we took into account information on the type of use of data, the perception of the tests' validity and the leadership style. Second, models of binary and multinomial logistic regression have been used to test associations between data use for school improvement and principals' opinions and attitudes towards INVALSI tests and their use. This approach also allows us to test the second hypothesis, with the introduction of interaction terms between attitudes to the tests and the promotion of collegial dynamics. The third approach refers to the relationship between principals' leadership styles and data use for school improvement. We identify the effects through a two-stage least squares (2SLS) instrumental-variables estimator.

Results. To sum up, we see that the more principals know and understand the test and their results, the more their opinions are positive, thus, the more they are likely to use data, orienting the school towards improvement. We also observe that the presence of both instructional and administrative leadership

translates in a clear direction and specific objectives for the school. This direction is oriented toward the school central mission: promote school change and improvement.

Giulia Montefiore, is a Sociology PhD candidate at the Autonomous University of Barcelona. She works on the Italian case in the REFORMED project, investigating autonomy and accountability policies internationally. She holds a M.A. in Education Policies for Global Development (GLOBED) and a B.A. in Politics and International Relations and Economics.

Gerard Ferrer-Esteban, (PhD Sociology) his main fields of research are comparative education, education policy, and equity in school systems. He has worked as a researcher on education policy and school effectiveness at the Agnelli Foundation and is currently working as a Marie Curie research fellow at the Autonomous University of Barcelona.

Use of INVALSI data for formative assessment activities in English teaching Cecilia Fissore - Marina Marchisio

Introduction. Formative assessment is a continuous process that sees students as active protagonists and that motivates them to advance in their learning. One of the key strategies conceptualized by Black and Wiliam (2009) for an effective formative assessment is to "Provide feedback that moves students forward". Effective feedback should indicate what the learning goals are, what progress is being made toward the goal and what activities need to be undertaken to make better progress (Hattie and Timperley, 2007). The importance of feedback is also highlighted in the literature on language assessment. Pallotti (2005) emphasizes the importance of giving students feedback on mistakes made with respect to correcting them. Balboni (2011) focuses his attention on a student-centered perspective in which, through continuous feedback, student can be monitored to verify the achievement of set objectives. Teachers in the classroom deal with a large number and variety of students. They can have concrete support in offering all students personalized feedback and teaching from educational technology. An automatic assessment system (AAS) is often used for summative assessment because it offers the ability to automatically evaluate, collect and analyze student responses. However, it can also offer support for a formative assessment, to give immediate, personalized feedback, to guide students in an exercise or to propose adaptive exercises. The Delta Research Group of the University of Turin has developed and tested a model for automatic formative assessment and immediate and interactive feedback with an AAS (Barana et al., 2018). This model was born for STEM disciplines but has also proved useful for other disciplines, for example for language learning (Barana et al., 2019; Marello et al., 2019). The training activities conducted (Barana et al., 2020) showed the effectiveness of an automatic formative assessment but at the same time highlighted the importance of training teachers and students in the use of technologies.

Research object and hypothesis. The object of this research is the design of material for a training course for secondary school English teachers, focused on the creation of questions for automatic formative assessment, useful for developing language skills, starting from INVALSI questions for standardized assessment. The research question is: how to use INVALSI data to design automatic formative assessment activities to facilitate the learning of the English language?

Data. The documents used for the research, available on the INVALSI website, were: the Common European Framework of Reference (CEFR) for the languages of the Council of Europe; the synthetic descriptors of English; English tests: reading and listening comprehension; the INVALSI tests at the end of the second cycle of education; the INVALSI 2019 test report and examples of INVALSI English questions at the end of the first and second cycle of education.

Method. The methodology for the design of the training material and activities was the following: study of the CEFR and the expected skills for the English language at the end of the first and second cycle of education; analysis of how the INVALSI English test is structured for Grade 8 and 13 and of the type of questions of the various tasks; analysis of the "INVALSI 2019 test report" and of the results in English in listening and reading to understand the levels reached by Italian students; study of examples of questions and design and implementation with the AAS of questions for formative assessment starting from the

INVALSI examples; finally, reflection on the strategies to be used to make formative assessment effective. Results. The listening and reading comprehension tests of Grade 8 and Grade 13 each include 5 different types of tasks (multiple choice question, multiple match, short open answer, true/false not given) to evaluate the level of knowledge of spoken and written English according to the standards established by the CEFR. According to the INVALSI report of 2019, at Grade 13, in the listening test, 65% of Italian students do not reach level B2 and 48% do not reach it in the reading test. The results are similar for Grade 8, except for the reading test results in which the majority of students manage to reach level A2. For the training of English teachers, more than 30 questions of different types have been designed and implemented for automatic formative assessment that allow the development of skills. For each of them, the strategies used have been indicated: provide the student with more attempts to answer the multiple matching questions in order to reflect on the errors, provide in the event of an error a sub-question to understand the error made, divide the audio to listen to or the text to be read in several parts to facilitate students' reasoning and understand where they encounter more difficulties, insert sub-questions to work on terminology and more complex verbal constructs, insert sub-questions to guide them in the exercise, alternate closed-ended questions with open-ended questions to allow them to explain what they understood. This type of activity, in addition to providing feedback to students, allows teachers to obtain information on the learning process of their students and to calibrate their teaching in real time.

Cecilia Fissore, graduated in Mathematics, is a PhD student in Digital Humanities at the Universities of Turin and Genoa. The research project concerns the development of digital methodologies for language learning, characterized by the use of a Digital Learning Environment integrated with an automatic formative assessment system. She collaborates in numerous research projects in the field of Digital Education. *Marina Marchisio*, is full professor at the University of Turin and Delegate of the Rector for the Digital Education. Her research is focused on learning and teaching Mathematics and STEM disciplines with digital methodologies and innovative technologies. She is a member of the Problem Posing & Solving working group of the Italian Ministry of Education. She coordinates several research and didactic projects and is the author of many publications on Digital Education.

Educational and didactic practices and managerial and organizational practices: a comparative reading of the RAVs of the Friuli Venezia Giulia region Dina Veronese

Introduction. In the school year 2019-2020, schools were committed to developing social reporting for the first time as the final moment of the strategic documentation cycle. In this phase it was possible to plan the re-edition of the new Self-Assessment Report (RAV) with the provision of useful evidence for the internal self-assessment process, as well as context data for the comparison between schools with the same socio-economic-cultural status of the student (ESCS). The "virtuous" connection between results, processes and contexts aims to favour an "acted" rather than "suffered" evaluation. The motivational drive was dictated by the fact that, as the survey by the Organization for Economic Cooperation and Development (OECD) suggests, schools that pursue some form of accountability achieve a higher quality performance of about 25%, compared to those who don't. The evidence collected shows a school that still pays little attention to the educational needs of a complex society capable of investing in social capital (participation and cooperation of students, families, communities) and professional capital (knowledge, skills, staff values). The study of school RAVs, of the Friuli Venezia Giulia Region, (FVG), implicitly suggests the necessary elements for any training projects for school managers and teachers, also through the opportunities of the territorial's network of schools and function.

Object. The process objectives, referred to the "priorities" and "goals" that characterize the RAV and which are described in detail in the PTOF, have an annual value and find their right definition in the improvement and training plan. The choices made by the schools regarding the process objectives will subsequently be justified and recognized in the reporting phase. The new edition of the RAV was analyzed taking into account the characteristics of a good RAV, that is the adequacy, consistency, reliability, relevance and

concreteness according to the principles of equity, participation, quality and differentiation, as suggested by the "Methodological note and operational guide "of May 2019.

Data used. The data used are: - training monitoring, prepared by the writer, for the regional school office at the end of the 2016-2019 three-year period, as provided for in the "plan for the training of teachers"; - "School Questionnaire" data by INVALSI, on the use of networks (regional, area, purpose) as a common denominator and resource to improve the participation of all stakeholders and the educational plan also through the differentiation of educational paths. The above graph illustrating the use of the funds available for training is shown as an example. Organizational and educational autonomy and evaluation and improvement are just over 20% of the total expenditure of the various school levels.

Method. The method followed is that of empirical research which, starting from hypotheses suggested by theoretical assertions, justifies "reality" according to rules established in a conventional way by the scientific community in order to produce controllable knowledge, as Karl Popper suggests. The education at the University of Bologna, by the scientific director Prof. Angelo Paletta, was particularly instructive as it made the application of this method possible. The formal procedures have made the itinerary followed transparent, facilitating the communication of the results obtained and linking them to what the literature makes available on the subject. From an epistemological point of view, it is possible to argue that the quantitative elements supported the explanation of the results obtained because they were representative of the number of documents observed, while for the qualitative elements an understanding of the same results was sought.

Results. The results achieved are illustrated with summary graphics and available in the complete contribution, but they are also useful evidence for the following objectives: 1. to give a refund to the contributions of all the schools in the region through a comparative reading of the documents; 2. To identify training paths for the representatives of the schools that deal with the drafting of the RAV in a way to improve it; 3. To understand the importance of doing research inside and outside one's own school. The graph shows the greater (value 5) or lesser (value 1) adequacy to the characteristics of a good RAV relative to the result areas with available evidence. Furthermore, data was collected on the process objectives that the schools have chosen in relation to the priorities and goals for the different areas of the outcomes, offering both an overall and a specific reading. The research involved the analysis of data related to all the institutes in the region (159 effective out of 167 total).

Reflections. Taking the steps towards forms of cooperative accountability, capable of creating consensus on the choices and investment projects of the school, through the participation of the actors of territorial governance according to the principle of co-production of value, is still an uphill path. If both types of practices contribute to improve the quality of the education system, it is implicit that the least investigated practices are those that need more training.

Dina Veronese, is a Primary school teacher, used at the USR - Friuli Venezia Giulia - Direction for the performance of the tasks of Area 5 - National Assessment System And Support To INVALSI National Reviews, she concluded the training course on "The Social Report for School Institutions: between accountability and social responsibility" at the University of Bologna.

Before data: Alignment, assessment of learning and INVALSI frames of reference Serafina Pastore - Cataldo Scarnera - Lucia Pallucca

In a standards-based perspective, assessment data, and more specifically, standardized assessment data, allow to understand what students have learned and how they are evolving in the achievement of the expected learning goals. However, the data have a sense on the backdrop of concepts, theories, and interpretative frames of reference. In this perspective, the concept of alignment is relevant: it represents the link between the expected learning outcomes and the needed instructional processes and the practices (e.g., assessment). In order to avoid inefficiencies, as well as practical problems related to the misalignment between test and curriculum (e.g., confused information reported to teachers on what they should teach or on to what extent their instructional practice supports student learning) in an interim assessment system,

realized in a school, a control process of tests realized by teachers has been introduced (37 teachers involved). The interim assessment tests cover, like the INVALSI tests, the domains of Italian language, Math, and English. The interim assessment tests system has been linked, on the one hand, to the INVALSI tests and to the INVALSI frames of reference, and on the other hand to the school's curriculum. Moreover, these tests have been related to the RTTI taxonomy of learning. More specifically the RTTI taxonomy of learning (Remember/Training/Transfer/Insight) and the AERA, APA, NCME Standards (1999) have been used to support teachers in setting learning goals, as well as in defining contents domains, and in posing questions. The Kendall index has been calculated to measure the teachers' agreement about the learning outcomes and learning goals in the RTTI matrix. Furthermore, in order to ensure reliability, reduce bias, and gather robust information on the levels of learning achieved by students, the measurement of the grade of alignment of the tests constructed by teachers has been performed. The index of alignment has been used to address the grade of alignment between the interim assessment test contents, the standards of learning (Indicazioni nazionali and INVALSI reference frameworks), and the school curriculum. This paper, on the one hand, reports results achieved, as well as the model of construction/validation of the interim assessment test, on the other hand it offers the chance to critically reflect, also with a comparison with the perspective of a formative use of INVALSI tests (INVALSIopen), on strategies and modalities aimed to integrate, in a coherent and cohesive way, different forms of assessment and different sources of data on student learning.

Serafina Pastore, is currently researcher at the University of Bari. Her research interests centre on educational assessment, formative assessment, quality assurance in the higher education field, and teacher assessment literacy.

Cataldo Scarnera, is Research Manager at ISTAT. His main research interests focus on the labour market statistical survey (e.g., workforce, professions), information systems design, data analysis with web scraping techniques, and data analysis at the micro-level for schools in the Apulian district. *Lucia Pallucca*, is a former school principal.

Student performance data-use: If you build it will they be used? Serafina Pastore - Cataldo Scarnera - Lucia Pallucca

Related to the spread of standardized assessment there is a relevant growth of systems and technologies aimed to store, manage, analyze, and report data on student performance. Despite the broad recognition of advisability of using data on student learning for decision-making (at educational policy and practice levels) data use for instructional decision-making is not widely recognized. Few research studies, indeed, have tried to understand what school and teachers do with data on student learning. The present paper reports the main results of a teacher-inquiry project realized during the school years 2019-20 and 2020-21 and aimed to introduce an interim assessment in a primary and middle school in the South of Italy (37 teachers involved and 404 students). Given the microanalyses realized on the INVALSI data (s. y. 2018-19), teachers have designed and realized interim assessment tests modelled to the INVALSI test format and linked to the classroom instructional design. Descriptive analysis and factorial analysis have been performed in order to support teachers in reviewing the tests. More specifically in the review process teachers have considered the need to create new tests, more effective and efficient (in terms of time, administration, data collection, data analysis, and reporting). The new tests (s. y. 2020-21) have been revised using the RTTI taxonomy, the learning goals, and the expected learning outcomes settled in the INVALSI reference frameworks, and the school's curriculum. Moreover, the collection of micro-data and the reporting processes (in Microsoft Excel) have been revised, standardized, and made scaled-up. The merge with these "home-made" data on student learning and the INVALSI results have allowed teachers to reply to the question "How are we doing?" and, in a more radical way have supported teachers to define an interim assessment system that is aligned with the INVALSI test and the INVALSI frames of reference, as well as more sustainable. This research and training path clearly focused on methodological and practical aspects in standardized test design and administration shows interesting points for critical reflection on how to support teachers' assessment literacy and how to reinforce the data-use and the culture of student learning data-use.

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Lucia Pallucca, is a former school principal.

Who is the preschool coordinator? Profile and tasks of this key role in the Italian preschool system Cristina Stringher - Maria Huerta

Literature on quality in Early Childhood Education and Care (ECEC) settings converges in attributing a key role to ECEC leaders in developing quality at center level (Bertam et al., 2016; Douglas, 2019; Melhuish et al., 2006; Sim et a.l, 2019; Siraj-Blatchford and Manni, 2007). ECEC leaders may support children's outcomes by promoting improvement in the teaching-learning cycle (Sim et al., 2019). They may set shared and measurable goals, support training and teachers' professional development and may facilitate teachers' data use to improve quality (Schildkamp and Poortman, 2015). Despite these quite remarkable contributions to ECEC quality, the role of leadership in ECEC centers is still under-researched (Douglass, 2019), particularly in Italy (Stringher and Gallerani, 2012). The aim of this study is to start shedding light on the characteristics of leadership roles within the Italian preschool landscape, characterized by mainly two types of leaders: directors operating within State preschools and coordinators in other public and private preschools with equal state status. We concentrate on this latter type and perform a descriptive and exploratory analysis of their profile, including main activities, within Italian preschools of two types: municipal and private. The reason for this choice is threefold. The role of preschool coordinators in non-State settings is not regulated nationally and wide variation exists in the pre-requisites of entry into the profession. Within the 2018-2020 Italian experimentation of the INVALSI Preschool Self-Evaluation Report Format (PSERF), only these two types of leaders were asked to fill in the second part of the preschool questionnaire. It is precisely on these two types of leaderships that the literature is particularly scarce in Italy and no national study existed so far on their characteristics. We use data from the preschool questionnaire administered within the 2018-2020 experimentation of the INVALSI PSERF and we specifically analyze data of the second part of such questionnaire (19 questions), dedicated to preschool leaders of municipal and private settings. Scope of this section was to collect information on personal and professional characteristics of non-State preschool leaders, together with their leadership style. The questionnaire, inspired by the TALIS 2013 leader questionnaire, allowed collecting information on the following areas: - leaders' demographics; - initial and in-service training and professional experiences; leadership style and activities; - self-efficacy and job satisfaction. In the period May-June 2019, the questionnaire has been administered online to a statistical sample of Italian preschools (N 397) and to another sample of self-candidate schools to the PSERF experimentation (N 1,100), for a total of 1,497 questionnaires collected. However, given that the questions concerning leadership were reserved only to non-State preschools, we filtered answers to the second part of the questionnaire, as State leaders were not asked to fill in the questionnaire for institutional reasons. We consider this selection to be a convenience sample (N 517) of Italian preschool leaders in private and municipal settings. We performed descriptive statistics on this data and cross-tabulated leaders' responses by their main demographics. Results show that non-State preschool leaders are predominantly females (94%), aged 50 on average, with a total of 10 years of experience in that role. Almost 55% hold an ISCED 3 or 4 degree, and only approximately 45% hold an ISCED 5 degree or higher, though these percentages vary according to leaders' age (the younger being better educated). This is a considerable difference compared to State preschool leaders, who must be tertiary graduates to access the profession. In addition, their initial and in-service training seems to be rather weak in supporting pedagogical leadership skills: 45% of leaders aged 26-39 and with an ISCED 3 degree have never received such type of training. According to their responses, responsibilities of coordinators are mainly concentrated on: 1) keeping contacts with local stakeholders, such as social services and municipal authorities (67% of interviewees selected this option); 2) liaising with parents (58% of coordinators); 3) defining procedures for the observation of child developmental outcomes (almost 51%) or setting behavioural rules for children (almost 51%). Some variation exists on this distribution of responsibilities

according to coordinators' age and educational level. However, when asked to quantify these responsibilities out of their routines, coordinators declare that only approximately 7% of their time is spent on contacting local stakeholders. For the most part, coordinators spend 27% of their time on pedagogical functions, such as meetings on the local curriculum and on educational activities, classroom observation on children's development and learning, tutoring and training teachers. The considerable amount of time spent with children, 25%, seems to be in line with the previous tasks, but could also imply a double role of the coordinator, who could also take on a more direct teaching role. Less prominent, but still important, appear to be administrative tasks, absorbing 23% of coordinators' time. This division of time seems coherent with coordinators' most frequent activities: more than 30% declare that they almost always or quite often collaborate with teachers in solving disciplinary issues, or observe teachers' didactical practices, or support teachers in finding didactic practices more responsive of children's needs. We discuss implications of these findings for policy in light of the TALIS 2013 survey, particularly considering the concept of "instructional leadership" and "educational leadership" and respondents' demographics. We address study limitations to be considered in future studies of this kind.

Cristina Stringher, PhD, is a researcher at INVALSI and currently leads an international team for the study Learning to learn in Italy, Europe and in Latin America. At INVALSI, she also manages the Italian experimentation on preschool quality indicators. She has been invited speaker in numerous international fora on these themes.

Maria del Carmen Huerta Guerra, Phd in Social Policy at the London School of Economics, is a policy analyst with extensive international experience in ECEC, child well-being and socio-emotional skills. She is researcher at Imperial College/London and has worked in international projects for the OECD, the World Bank and UNICEF.

The Mathematics teachers specialised knowledge and the Gestinv Database: Pre-service teachers' professional development paths for the improvement of Mathematics teaching George Santi - Federica Ferretti - Francesca Martignone

Introduction. Standardized assessment (SA) can improve the teaching and learning of Mathematics only if it is able to give effective operational information to educational institutions (De Lange, 2007). We believe it requires an encounter between SA, Mathematics education research and teacher education.

Objective, research hypothesis, INVALSI data. In this study, we present a model for the improvement of the Italian educational system in Mathematics that profits from data collected by INVALSI. Our model creates a link between INVALSI data and Pre-service Teacher Professional Development (PTPD) to trigger a virtuous loop between SA, PTPD and Mathematics teaching. Our model relies on GESTINV database.

GESTINV is the pivotal tool of a model for teacher collaboration devised by Ferretti, Gambini and Santi (2020). Teacher development is conceived as the sprouting of a new identity (Golding et al., 2016) that involves beliefs, attitudes and values regarding both Mathematics Knowledge (MK) and Pedagogical Content Knowledge (PCK) (Carrillo-Yañez et al., 2018). The new identity is the outcome of a sociocultural activity mediated by specific tools. Ferretti et al. (2020) envisage PTPD as the interplay of a Community of Inquiry (Jaworski,2006) and the Mathematics Teacher Specialized Knowledge - MTSK (Carrillo-Yañez et al., 2018) that outlines the culture contributing to teacher identity. GESTINV serves as the mediator of this sociocultural activity.

We have significative data as regards the INVALSI assessment and we have implemented our collaborative PTPD model widely, involving primary pre-service teachers.

Methodology. The overall methodology of our research program is based on the following cycle: SA carried out by INVALSI; Results of Large-Scale Assessment inform a large-scale Teacher Professional Development (TPD) making use of GESTINV and e-learning platforms; TPD translates into more effective and aware Mathematics school practices, tested with SA that initiates a new cycle.

In the presentation, we focus on the PTPD based on the following methodology:

- Introduction of the activity. The researchers discuss with the pre-service teachers the Mathematics education constructs, also looking at learning difficulties, that will be useful for the activity. Moreover, the researchers present some of the functions of GESTINV that the teachers will use in their inquiry. The researchers address the mathematical content selected for the activity from a conceptual and epistemological point of view;

- Analysis of an example. The researchers discuss with the whole group of pre-service teachers a didactical macro-phenomenon using GESTINV within the MTSK model stressing the MK and/or the PCK;

- Group activity. Students autonomously divide into sub-groups of maximum 4/5. The researchers assign a task covering a mathematical content, a learning difficulty, a cognitive process related to one or more subdomains of the MK and the PCK that are developed according to objectives and goals of the Italian National Guidelines. The small group activity is carried out according to a Community of Inquiry group, strongly interacting with GESTINV. The group activity aims at the construction of a multimedia product, an artefact, the design of an activity for students etc., which should highlight pre-service teachers' reflections, convictions and beliefs;

- General discussion. The sub-groups present their materials to the big group. Each presentation is discussed within the Community of Inquiry in order to highlight beliefs and convictions, tackle doubts, difficulties and unclear contents regarding both the MK and the PCK and outline the subdomains of the MTSK that emerged from the activity. Another setting for this final phase requires each sub-group to prepare a written presentation that is exchanged so that each sub-group presents orally to the big group the material of another sub-group. The final discussion, based on the oral presentations, is performed with the same characteristics of a Community of Inquiry.

Results. In the presentation, we will show the link established by GESTINV between INVALSI data and TPD. We describe how the structured data provided by GESTINV informs the contents of the activity plan mentioned above and materials that show the pre-service teachers' change of identity triggered by the INVALSI items.

A change in the Mathematics pre-service teacher's identity could transform their future Mathematics school practice and their interpretation of the data provided by the standardised tests, as to accomplish an improvement of the Educational System. We have collected data concerning results that involve the implementation of INVALSI data via GESTINV and the first uses of our PTPD design at a local level.

George Santi, PhD in Mathematics, is a researcher at the University of Bolzano. His research focuses on the networking of semiotic perspectives in Mathematics Education related to several research issues concerning the teaching and learning of Mathematics.

Federica Ferretti, PhD in Mathematics, researcher in Mathematics Education at the University of Bolzano-Bozen. Her research concerns the Didactic Contract at all school levels, formative assessment in Mathematics and the formative use of standardized assessment. For years she has been involved in Mathematics teacher's professional development.

Francesca Martignone, PhD in Mathematics, associate professor at the University of Eastern Piedmont. Her research concerns the institutional, epistemological, cognitive and didactic aspects involved in mathematical education, with particular attention to the issues of teacher education and assessment.

Teachers' pedagogical autonomy, professional development and students' digital skills: New evidence from Italy

Kalyan Kumar Kameshwara - Nurullah Eryilmaz - Andres Sandoval-Hernandez

In light of the recent education reforms in Italy (La Buona Scuola, Law 107/15) featuring autonomy and digital skills, this paper examines the impact of teachers' pedagogical autonomy on students' computer literacy. The empirical analysis is conducted using data from the latest cycle of the International Computer and Information Literacy Study (ICILS 2018) in which Italy participated for the very first time. ICILS is a quinquennial survey conducted by the International Association for the Evaluation of Educational Achievement (IEA) since 2013. The main aim of ICILS (2018) was to capture the eighth-Grade students'

competence levels with regard to the use of information and communication technology (ICT) and their prospect of capitalising on their digital skills in terms of their future careers. Hierarchal linear modelling was used to conduct the analysis as it accounts for the clustering of data. The results from the random intercepts models show that teachers' pedagogical autonomy in itself is not significantly associated with students' digital skills, but that when combined with certain types of professional development, it can positively influence students' computer literacy. Based on our results, we argue for more localised resources and opportunities to be used for teachers to engage in reciprocal professional development via spontaneous peer support and learning over top-down standardised professional development programmes. This paper aims to tackle one of the important knowledge gaps which has direct policy and practical implications concerning the effects of two predominant forms of professional development activities. This study makes a strong case to promote reciprocal learning (peer to peer or collaborative learning) based on professional development alongside granting teachers more autonomy in matters of pedagogy. It is beneficial to the schools and students, to facilitate interaction among teachers as part of professional development activities especially when they are responsible for taking decisions concerning ways and methods of teaching and assessing student learning. This study is also significant as it employs nationally representative data which allows for the generalisability of the findings. This aspect is important to stress because it allows for the scalability of practices that are effective in improving achievement levels.

Kalyan Kumar, is an ESRC funded student pursuing his PhD in Advanced Quantitative Methods at the University of Bath. His doctoral study uses econometric and psychometric tools to investigate questions in education research. His current research interests fall in the domain of social statistics, educational inequality and philosophy.

Nurullah Eryılmaz, is pursuing his PhD in Education at the University of Bath. His doctoral thesis focuses on studying educational inequality and its effects on student outcomes using International Large-Scale Assessments (ILSAs). His current research focus falls in the domain of comparative education, sociological theory and psychometric analysis.

Andres Sandoval-Hernandez, is Reader in education research at the University of Bath. He has previously worked as Head of the Research and Analysis Unit at the International Association for the Evaluation of Educational Achievement (IEA) in Germany. His current research focuses on comparative analyses of educational systems using large-scale assessment data.

Do secondary school teachers grade female student more generously? A multilevel regression analysis on student-teacher matched data Ilaria Lievore

Over the last century, the existence of striking gender-related gaps in educational outcomes has been widely demonstrated almost all over the world (Goldin et al., 2006). A significative amount of research focused on gender inequalities in educational achievement, that is differences between male and female students in cognitive ability measured by standardised tests. However, little attention has been devoted to analysing differences in how teachers grade their students according to their gender and conditionally on the same performance. Gender bias in grading exists when female and male students receive different evaluations when they have the same ability. In the last few years, some researchers tried to assess whether there are systematic biases in grading students related to their gender, and studies have shown that teachers assess female students' performance higher than male students' one, with the former getting significantly higher grades both in Mathematics and language (Lindahl, 2007; Lavy, 2008; Falch and Naper, 2013; Kiss, 2013; Angelo, 2014; Terrier, 2015; Enzi, 2015). Indeed, the way in which teachers evaluate their students is a combination of different factors together with students' ability and capacity, among which social habits and considerations (OECD, 2013), teachers and students' characteristics, the interaction between such characteristics (Costrell, 1994) and the context in which the relationship develops. I am interested in understanding to what extent secondary school teachers grade more or less generously female than male students in Italy. Moreover, the literature lacks of a comprehensive assessment of the gender gap in

teachers' grading and how it varies across educational contexts and according to teacher characteristics. For this reason, this study examines which characteristics of students, teachers, and contexts are likely to enlarge or decrease such grading mismatch. This study analyses 2013-14 INVALSI-SNV Italian data, through which it is possible to link information on 10th Grade students with those on their teachers. These sources provide information on test scores, teachers' grades, students' attitudes and educational expectations. Information on teachers is derived from a questionnaire administered to the teachers of the two subjects on which the students are tested (Italian language and Mathematics) and includes teachers' sociodemographic characteristics and teaching habits. The sample size is around 30,000 students. The objective of our analysis is twofold. First, the assessment of the extent to which female students are graded more generously by their teachers compared to male ones. Gender grading mismatch is measured by comparing the average marks of boys' and girls' in Mathematics and language in "non-blind" classroom exams to the respective means in a "blind" national exam (INVALSI test) marked anonymously. Second, the assessment of the characteristics of students, teachers, classrooms and school that are likely to enlarge such grading mismatch. The study relies on grade equation models embedded in hierarchical linear regression analysis, in which students are the first level, classrooms are the second level, and schools are the third level. This model takes into consideration the hierarchical nature of the data, provides correct standard errors and constitutes a general analytical framework to investigate by means of cross-level interactions whether the advantage of female students over male students varies across 1) school types, 2) classroom characteristics and 3) teacher characteristics. Results show that teachers are effectively more likely to give higher grades to female students, and this premium for females is systematic. That is, teacher and contextual characteristics do not have any effect in increasing or decreasing the advantage of female students over male students. The study and the investigation of gender grade differentials conditional on the same performance is important for several reason. First, teachers' biased behaviours have long run implication for students' future school choices, occupational choices and earnings in adulthood (Lavy and Sand, 2015). Second, the discrepancy between teachers and tests can result in the so-called "self-fulfilling prophecies" (Babad, Inbar and Rosenthal, 1982; Brophy, 1983). When teachers have specific expectations about the intellectual ability and growth of a student, the latter is more likely to actually show this intellectual ability. Teachers' gender bias can thus result in an actual performance drop of the under-evaluated students, who may feel intellectually discouraged. Finally, the findings could provide useful elements in the discussion of the emerging topic of disadvantaged boys in school.

Ilaria Lievore, is a PhD student in Sociology and Social Research at the University of Trento, Italy. Her main research interests concern educational stratification, inequalities in educational outcomes, teacher bias and the measurement of cognitive and non-cognitive skills, using an analytical approach focusing on mechanisms at the micro-level.

THEME 1. INEQUALITY SITUATIONS AT SCHOOL: DETECTION METHODS AND BEST PRACTICES FOR THE SOLUTION

THEME 6. INVALSI DATA AS A TOOL TO SUPPORT INNOVATION AND SCHOOL IMPROVEMENT

ORGANIZER: INVALSI

COORDINATOR: GIORGIO CAVADI FEBRUARY 25TH: 17.15-19.30 {ROOM LORIS MALAGUZZI - TEACHING 1}

Mathematics, learning and teacher training Ester Valloreo - Francesco Mammarella - Roberta Franchi - Ettore D'Agostino

Introduction. During the school year 2019-2020, the Istituto Omnicomprensivo of Città Sant'Angelo (Primary, Middle and High Schools) for a total of 1337 students, has started a path on the perception that each student has, in relation to his skills, level of self-esteem and motivation in relation to Mathematics, accompanied by a self-training of teachers, which involved in particular newly hired teachers and their tutors.

Object and research hypothesis. In this presentation we describe what was done in the High School "Spaventa" (in the second and third grades of the Linguistic, Applied Sciences, Sports, Human Sciences and Social-Economic courses) first as an investigation on the perception of competence in Mathematics, then on the application, decomposition and re-composition of several tests of Mathematics, according to the framework of Mathematics. The work is consistent with the National Indications, which stress the importance of developing in students the ability to communicate and discuss, to defend an argument correctly, to understand others' points of view and arguments.

Data used. What started in class was then reformulated and proposed also in the online learning approach through the prerequisites of cognitive and metacognitive processes investigated in the national tests that enabled the pupils to address the problem initially established. At the same time, the adherence to the competitions and mathematical games for the first time, by the whole Institute, allowed to work with a database, in order to facilitate the teaching/learning process. The activities have privileged the construction of a model to solve a problematic situation, starting from the conditions and relationships between data and unknowns and arriving at the consequent solving procedure.

Method. In the course of the didactic activities, first in presence and then in online learning during the lockdown period, the exploration of mathematical concepts has been promoted in order to encourage the formulation of simple conjectures, argumentation and reflection among peers and with the teacher. The teacher assumed the role of mediator and facilitator and at the end of the teaching proposal, the teacher motivated the pupils to reorganize what they learned. Various activities have been developed that have stimulated the students to a careful and critical reading of graphs, with reference to real situations in order to learn how to compare different graphs and how to choose the appropriate conditions for their construction. The training objectives focused on how students are able to use representations of data in significant situations to obtain information; to construct reasoning and support their theses thanks to laboratory activities, peer discussion and observation of models; to use representations to obtain information.

Results. All students in the concerned classes have learned how to use the dynamic geometry software GeoGebra. The learning goals and objectives were: to use GeoGebra as a tool for conjecture and concept building; to recognize numerical relationships in geometric contexts; to explore through software, to reflect and conjecture, to defend an argument among peers and with the teacher. The problem-solving phases of a problem have been elaborated by the students using tabs, passing from natural language, in which the proposed problems are formulated, to algebraic language, arriving to find a model and the solution of the problems. Many examples of activities carried out (the problems have been modified and adapted to the classes and to the online learning period) have been included in our Institute database built during the online learning period. This way, the incoming data were analysed with ongoing and final results. On various occasions, in our school, an active and constructive collaboration between the teachers of different school

levels, has been established, also teachers who had never used multimedia as a classroom environment. They have been working on different projects such as: organization and implementation of mathematical games, incoming orientation, support to the work of colleagues during the Class Councils or for other tasks of the teaching function, adoption of the so called "books in progress" for future first year students coming in 2020-2021. We developed a path of self-training and systematization of best practices also through periodic meetings in which were shared: results Of Mediterranean Youth Mathematical Championship And Mathematics Without Borders; INVALSI results 2018-2019; the use of diversified tools in the evaluation of Mathematic-Physics and the processes of formative evaluation during the online learning with items selected by the GESTINV platform. The Mathematics and Physics teachers, in the probationary period, were involved in the analysis of the results of the INVALSI tests, parallel tests and tests of the competitions carried out online for the first time for both Mediterranean Youth Mathematical Championship and Mathematics Without Borders. This Last competition involved the entire Class Council. Finally, the self-training, among peers, tutors and newly hired teachers, through the GESTINV platform, has laid the foundations to review the curriculum and teaching strategies in the school year 2020-2021 also in consideration of ILP (Individual Learning Plan) and LIP (Learning Integration Plan).

Ester Valloreo, is a Mathematics and Physics teacher. He has worked as a member of the support staff in the office of the Principal for several years. As the school INVALSI representative, she is in charge of analysing and interpreting INVALSI data in order to improve students' learning levels.

Francesco Mammarella, is an English teacher.

Roberta Franchi, is a Language and Literature teacher. She has been Vice Principal for two years. During her university studies, she worked as a free-lance journalist for Il Messaggero and at the moment she is the Editorial Director of the School Magazine "L'Angolino". She has a large experience in National Operational Programmes on Education.

Ettore D'Agostino, teaches Maths and Physics. He is a member of the school Digital Innovation Team and contributes to computerize school processes, collect and elaborate data for school statistical surveys.

GeoSkills: a way to extend the application of INVALSI questions by including them in Geometriko! Leonardo Tortorelli- Nicola Chiriano - Marianna Nicoletti - Emanuela Conte

GeoSkills is an activity integrated with "Geometriko", which is a research project in the field of the Didactics of the Euclidean Geometry started in 2014 and based on the didactic game, also known by the same name. This game is used as an instrument for the evaluation of competences and skills of pupils. The "Geometriko" project is managed by the Centro Pristem of the Università "L. Bocconi", Milan, Italy, and it is based on two pillars: 1. The "Geometriko National Tournament" or, in Italian language the "Torneo Nazionale di Geometriko" (TNG) and 2. The "Geometriko Didactic Model". The first one, the TNG, has seen in 2020 alone 26,000 pupils subscribed from any school grade. Its aim is to make more innovative and appealing the geometry's learning by stimulating curiosity, participation and motivation of pupils. The second has the aim to improve the geometry's competences. The classes subscribed to the TNG start the learning path by challenging each other in a Geometriko tournament within the class itself. They do it using a number of questions called "GeoSkills". This will be followed by a tournament involving the whole school. The winner students will move to the National "quarter-finals" to then end with the national phases (Semifinal and Final). During a Geometriko match a pupil has to answer to two questionnaires. Due to Covid-19, the TNG 2020 had to be run online. In this case such questionnaires have been answered simultaneously by all participants by using a Google Modules. The national format will be suggested in the same way in the TNG 2021 (class tournament). In this way the questionnaires proposed could also be evaluated by the teacher as a written test. Each questionnaire is made of 5 items with different level of difficulty, GK1 being the easier and GK5 being the most difficult. One or more of the 5 items belonging to the same questions - called calibration's items – are taken from the archive of the questions given by INVALSI (an Italian way to test pupils in every school to evaluate the level of the school) - mostly in the field of Space and Shapes -. From them the remaining items are built as follows. First of all the level of the calibration is established from the

percentage of correct questions of the sample (as reported in GestInv.it) on the base of the distribution in quintiles, taken in decreasing order. i.e. to an item corresponding to 36% of correct answers (interval from 40% to 20%) will be attributed the level GK4. Then the questionnaire is assembled as follows: 3 items of GK1, GK2 e GK3 level respectively, which are easier of the ones of the calibration item (level GK4) and then finally a more difficult item (level GK5). After having submitted the questionnaire, the teachers will send the answers via the Goole Modules to the Scientific Committee. The latter will use the data collected in order to monitor the level of learning on a national scale as well as to deepen the statistical data about misconceptions emerging from data, which will allow to identify the possible causes and therefore improving the preparation of the TNG 2022. The questions have been created by the authors using a shared platform (G Drive and G Doc).

Leonardo Tortorelli, Mathematics teacher in the high school Liceo Scientifico "L. da Vinci" di Maglie (LE), Italy and for the University of Bari. He is also the main scientific referent for the "Geometriko project" in the Pristem Center in the University of Bocconi, Milan, Italy. He is also author of the books for Mathematics teachers: «Quaderni di Geometria Verticale» (published by Dedalo, Italy) as well as author of the didactic game and method "Geometriko" published by Erickson, Italy.

Nicola Chiriano, teacher of Mathematics and Physics at Liceo "L. Siciliani" of Catanzaro. Regional trainer for SNV, INVALSI author, collaborator with the Pristem Center of Bocconi University (Alice & Bob magazine) and Perugia University (Matematica&Realtà project). He's interested with ICT's in education and CLIL.

Marianna Nicoletti, master degree in Mathematics, she teaches Mathematics and science in middle school. She collaborates with INVALSI in the construction of mathematical assessment tests. She's the author of books for the learning of Mathematics and in particular for students with special needs.

Emanuela Conte, teacher of Math and Science in I.C. "Alighieri Diaz". INVALSI author grade 2 e 5, she treats "Quality, valuation end self-evaluation of the institute about Primary and Nurcery school. She cooperates with the research group in Didactics of Mathematics in the University "Alma Mater Studiorum" in Bologna.

A training path on linguistic and text comprehension difficulties in INVALSI Mathematics texts Stefania Pancanti

In this paper we describe a training course for teachers of Secondary School on linguistic and text comprehension difficulties in mathematical problems. The focus of the course is to supply contribuction in the improvement of teaching with relation to text comprehension in standardized tests, in particular in INVALSI Mathematical text. In the II Seminario and in the IV Seminario "I dati INVALSI: uno strumento per la ricerca e la didattica" has been underlined how linguistic difficulties and text comprehension could cause wrong answers in the standardized texts, producing unsuccessful results, so that a new theoretical framework has been presented that allows the identification and interpretation of possible linguistic difficulties and text comprehension from the analysis of the text itself. In particular, adopting this theoretical framework, it is possible to define classification criterions of a text that allow to link text characteristics with the possible causes of a not correct construction of the mental model by the interpretation process. This framework is the theoretical content of the teacher training path we propose in this work. The training path is divided in stages and it has the purpose to train teachers in relation to idenification, interpretation and didactic interventions on linguistic difficulties and text comprehension in mathematical problems. A train path on these contents, that allows to move from knowledge to skills, requires long times because it is necessary to read and compare many texts. Taking in consideration the type of recipients of the course, this train need to be very individualized and for this reason it is realized in E-Learning mode, in blended form. Furthermore, the development of the course on a digital platform allows the comparison and collaboration between the participants, for which the reflection on the linguistic problem takes place not only through the contents of the course but also through the reciprocal interaction on written language. The training path has been realized on Moodle Platform exploiting its properties of flexibility and modularity. In this work two experiments of the training course will be presented: a first one, in a Master "Formatori in Didattica

della Matematica" and a second one, in a training course for Secondary School teachers, in relation with "Lauree Scientifiche" Project.

Stefania Pancanti, Mathematical and Computer Science teacher. She has got a Doctoral Degree from Florence University. She is a member of Mathematical Didactics Research Group of Pisa University and she has received some tasks in relation with "Lauree Scientifiche" Project; in particular, she has conducted a teacher training course.

Lesson Study and teacher training: lesson plan starting from INVALSI test results Roberto Capone - Maria Giuseppina Adesso - Oriana Fiore

In this study, a teacher training project in the Secondary School based on the Lesson Study, a collaborative methodology rooted in Confucian heritage culture, is described. The Lesson Study, since it was first formalised in Japan in 1872, has become a widespread practice throughout the world today, especially in the Anglo-Saxon and Scandinavian world. The Italian experience of the Lesson Study methodology was born in parallel in the two Universities of Turin (Robutti et al., 2016) and Modena-Reggio Emilia (Bartolini, Bussi and Ramploud, 2018). The former has its origins in the training of secondary school Mathematics teachers and in the deepening of Japanese culture. The second focuses on teaching and research in the Primary Education Science degree course, and in the study of Chinese culture. The Lesson Study experience carried out by researchers at the University of Salerno is based on this tradition. The Lesson Study is based on the collaboration between teachers who constitute a real community by sharing their teaching experiences, disciplinary and pedagogical knowledge, methodologies. This project group chooses a theme to be discussed and proposed to the students. Long-term learning objectives are defined, and the lesson is planned; the lesson is then implemented in a classroom and observed by a team of teachers; finally, the progress of the lesson is discussed. These phases can be repeated, like a life cycle in which each lesson is the basis for new growth. A group of at least three teachers, usually with some university experts and future teachers, collaborate on the detailed planning of a one-hour lesson, which will be held by one of the teachers in his class and observed by the others and discussed by the group. The aim is to build lessons by taking away any critical issues in order to foster the creation of learning environments where students can achieve the best results. From the discussion with other teachers and researchers, skills are acquired in time management and in the early identification of critical points in the teaching action. The activities carried out with this experimentation arise from observations on the teaching of geometry in secondary school, which, as shown by INVALSI returns in recent years, seems to be the category in which students encounter the greatest difficulties. The Lesson Study activities have been designed with the aim of eliminating these criticalities after reflecting on the most evident misconceptions that have emerged from some INVALSI evidence in recent years. Taking into account the National Indications and the three-year teaching plan of the School, the teachers decided to organize a long-term planning, planning a Learning Unit: the art of Geometry divided into 5 activities: Equiscomponibility, Pythagoras, The Root of Two, the tassellations, the Golden Section. There are many reasons for the choice of these topics, in addition to the already mentioned "low results in national standardised tests". These reasons are both didactic, cultural and epistemological: - these topics belong to a consolidated Italian tradition of teaching Geometry, which has its roots in a deeper cultural tradition, the Greek one; - These themes are strongly linked to the strengthening of linguistic, intuitive-spatial, visualization, problem posing and problem-solving skills; - these themes provide a valuable teaching tool for students' understanding of an axiomatic-deductive system. The pilot teacher suggested to experiment the study of the lesson in activity 4: "Tassellations". The theme is interdisciplinary and links Mathematics, natural sciences and art: it fits perfectly with the objectives of the Mathematical High School project. We will show how teachers, through careful planning of activities, analysis of students' needs and observation of teaching practices, assisted by the experience of some researchers, have become promoters of their training. We will also show how teacher training is the driving force behind educational innovation and this is the source of the students' educational success.

Roberto Capone, is research fellow at Mathematics Department University of Salerno in Mathematics Education. Here, he is temporary professor of Calculus. He is Chemistry Engineer, Mathematician, and PhD in Mathematics, Physics and Applications. He is involved in research activity about Math education focusing on teacher training, new methodologies, use of historical artifacts in Mathematics education, interdisciplinarity, Mathematics and NLG language. Recently his interests also include the psychology of Mathematics.

Maria Giuseppina Adesso, is a physicist and a Math and Physics teacher at high school. PhD in Physics at University of Salerno and Geneve. He was research fellow in Mathematics education in 2018-2019 about "Semiotic mediation and embodied cognition in correlation to the two cultures". Her research is about history of Math and Physics learning, IBSE, use of ITC and historical artifacts in education, at Salerno University. Her recent publications are Mathematics Learning and Teaching in an Interdisciplinary Framework Simulating Ancient Academy and Discovering neglected synthetic geometry on Social Networks: learning Maths as in the historical Italian Academies.

Oriana Fiore, is a physicist and she is a Math and Physics teacher at a high school. She is involved in research activity about Math and Physics education, mainly semiotic mediation, IBSE, use of ICT, teacher training, at University of Salerno. Currently she is temporary professor of Physics at the Medical Department in Salerno. She is an effective member of the activities of many associations: AIF, SIF, Mathesis, GIREP, UMI. She is author of several publications in Mathematics and Physics Education.

A good practice of inclusive teaching in an intersectional perspective Giovanna Filosa - Maria Parente

Introduction. The Covid-19 emergency hit like a tsunami on the education and training system, requiring a sharp rethinking of the traditional ways of organizing education for children, young people, and adults. From a lifelong perspective, the introduction of distance learning (DAD) on one hand, and of smart working on the other, has caused strenuous resistance to new technologically enhanced learning tools, and it has highlighted all the limitations of training interventions, not adequately designed. As a matter of fact, the quality of training and education does not only concern with the introduction of innovative technological tools (and hardware/software infrastructures capable of supporting them), and the digital competence of teachers and trainers suddenly required to use them, but above all with a methodologically based design, which takes into account the fundamental mechanisms of formal and non-formal learning, as codified in decades of research on this matter.

Constructivist and constructionist didactics have placed three fundamental elements at the center of the learning processes: 1) a reliable and qualified source of information (teacher or trainer, but also the didactic material they provide); 2) an environment of social interaction, with the teacher but also between peers (class or classroom), real and/or virtual, synchronous but possibly also asynchronous; 3) a concrete goal, to be achieved through the knowledge acquired. Obviously, we must not overlook the fact that any learning involves both the cognitive axis (skills and abilities) and the emotional axis (interests, motivations).

Research subject and hypothesis. The reference context is the public Institute of Specialized Education for the Deaf (Isiss) "A. Magarotto" in Rome, which includes the cycles of kindergarten, primary school, lower secondary school, and upper secondary school. It was born from a school inclusion project, developed by the CNR, which transformed a boarding school for the deaf into a specialized school that hosts hearing and deaf students and pupils who have various disabilities, mainly of Italian nationality but also of foreign origins ("second generations"). The school has seven locations: five in Rome, one in Turin, and one in Padua. The goal is to describe good practice in terms of inclusive DAD, which can also be extended to other public and private schools, and to give policy indications regarding the post-Covid education and training system. The hypothesis underlying this contribution is that a methodologically based design is a critical success factor for teaching and an important indicator for the quality of a training offer that can be alternative to the face-to-face one.

Consequently, schools and training organizations that already practiced inclusive teaching have often been found to have an advantage in DAD, probably because their methodologies, theoretically founded, already aimed at creatively exploiting all the tools, technological and otherwise, designed to facilitate learning to all, able-bodied and disabled. From this perspective, diversity (not only functional but also cultural, ethnic, and social) has really been a resource that has "taught" how to convey content in an optimal way to the widest possible audience of learners.

Data used. The survey is based on qualitative and quantitative data. The quantitative background data used are from INVALSI, Indire, Censis, and Fondazione Agnelli sources.

Methodology. The qualitative data comes from a case study, through in-depth interviews with privileged witnesses (teachers, parents, Headmaster) coming from the context examined. The focus of the interviews is on teaching methodologies, on coping strategies with respect to the Covid-19 emergency of teachers, parents, pupils, and on the lessons learned for post-Covid. A qualitative textual analysis was carried out on the transcription of these interviews.

Results. From the case study, a good practice of inclusive teaching was reconstructed, able to adapt to the specificities of individual deaf and/or foreign pupils, who have never been left to themselves. The DAD, accompanied by individualized interventions for deaf children with autonomy and communication assistants, ensured the necessary didactic continuity even in the most dramatic phases of the pandemic. This practice may also guide other school contexts in post-Covid, with an intersectional inclusion perspective, in order to reduce inequalities in educational paths. As a matter of fact, the DAD is not a substitute for face-to-face teaching, but from a complementary perspective. This is the reason why it is necessary to understand what can be saved and what has to be improved in technologically advanced teaching, taking as a model the already existing successful practices.

Giovanna Filosa, technologist at INAPP, currently deals with the social and labor integration of migrants. Occupational and organizational psychologist, specializing in psychodynamic psychotherapy of the developmental age, in 2004 she obtained a doctorate in Psychology of interaction, communication and socialization.

Maria Parente, researcher at INAPP, where she dealt with the labor market, with particular reference to older workers, female employment, and the social inclusion of vulnerable groups, currently deals with the social and labor integration of migrants.

ADVANCED SECONDARY ANALYSIS OF LARGE-SCALE ASSESSMENTS IN EDUCATION:

A DISCUSSION OF METHODS

ORGANIZER: ANDRES SANDOVAL-HERNANDEZ COORDINATOR: ANDRES SANDOVAL-HERNANDEZ FEBRUARY 25TH: 17.15-19.30 {ROOM GIOVANNI FABBRONI – WORKSHOP 1}

Session 1

In this part of the workshop, participants will be introduced to the process of data cleaning and preparation for analysis in Mplus. The process will be illustrated with ICCS 2016 data and will touch upon issues specific ILSA (e.g., using the appropriate sampling weights, missing data treatment etc.).

Session 2

In this part of the workshop, participants will be introduced to latent class analysis (LCA) with ILSA data. The method will be illustrated with ICCS 2016 data on citizenship norms. Topics of cross-cultural comparability (measurement invariance) of latent classes and multinomial multilevel analysis will be illustrated and discussed.

Session 3

In this part of the workshop, participants will be introduced to structural equation models (SEM) with ILSA data. The method will be illustrated with ICCS 2016 data on young citizens' political participation and political socialization. Both measurement and structural SEM models will be illustrated and discussed.

Andrès Sandoval-Hernández, is a lecturer at the University of Bath. He has collaborated with various international organisations including the OECD, UNESCO and UNICEF. His research interests include comparative analyses of educational systems using large-scale assessment data, with a focus on educational inequalities and civic education.

Diego Carrasco, is a full-time researcher at the Centro de Medición MIDE UC at Pontificia Universidad Catolica, Chile. His research focuses on contextual effects, involving measurement and inferential problems for nested observations and on substantive applications for civic education, and learning environments research.

Daniel Miranda, is a full-time Research Scientist at the Centro de Medición MIDE UC at Pontificia Universidad Católica and Adjunct Researcher at the Centre for Social Conflicts and Cohesion Studies – COES, Chile. His research focuses on citizenship education, political inequalities and its intergenerational transmission across generations.

THEME 8. THE ROLE OF TEACHERS ON STUDENT ACHIEVEMENT Organizer: INVALSI Coordinator: Antonella Mastrogiovanni February 25th: 17.15-19.30 {Room Elisa Frauenfelder – Teaching 2}

Teacher and the student's success Fiorella Baldo - Angela Maria Giuliano

If there is no doubt that the purpose of a school organization is not only education but also the training of individuals who have to be part of society in an active way from an economic and political point of view, it is therefore true that the teacher plays a crucial role in this organization. The professional features of a teacher, therefore, depending on both objective factors (such as age, gender, quantity and quality of training received, work experience), and subjective factors (such as motivation, ethics, perception of the social prestige enjoyed), certainly influence students' learning and performances. The subject of our research is purely empirical and will focus on the role of the teachers of Italian language and Mathematics of the "G. Lombardo Radice" in Catania where we have been working for many years. The study of the INVALSI tests data performed in our high school by second year students from 2015 to 2019 will allow us to compare the data with the profile of the teachers of these classes, considering also the data of the final meeting for grading and the final State Exams, and therefore to analyze and compare 2015-2016 second year students data with 2018-19 fifth year students data. It is clear that there are many factors to consider: composition of the classes, teaching and assessment methods, the differentiation of curricula in the different school courses, teacher's motivation and incentives, teacher's training and career progression). The research starts from empirical data which helps us to consider the problem of teachers' evaluation and the role that incentives and professional training play in favouring in every way their involvement in the improvable goals of the school system, whether these goals be learning, academic goals or aiming to reduce school nonattendance. Incentives can be based on results (output-based) or performance (input-based). The distinction is blurred, given that the productive process of education has many stages. For example, keeping order in the classroom certainly costs teacher efforts and it is useful both for guaranteeing the quality of the educational input (lessons would be difficult to follow if noise would be allowed), and to foster socialization. However, this is a conceptually useful distinction for an analysis of the pros and cons of teacher evaluation and incentive policies. In order to evaluate the quality and quantity of the teachers' work, it is therefore also useful to put its result in the running. Evaluating the results offers the advantage of being able to tie salary to the objectives pursued, but it must face serious problems of evaluation and risks as teachers focus excessively their efforts on the inevitably inaccurate evaluation adopted as a reference. The results of the teacher's work, namely students' learning and fulfilment, are as important as the fact that they are difficult to be precisely surveyed and their evaluation cannot be entirely objective. It is obviously important to recognize and compensate both students and teachers for merit and effort, but it is equally important to bear in mind that it is a question of evaluating elements that are not always concrete and verifiable. Those who study and those who teach constitute a real essential society, but at the same time less clear than, say, vegetables and pasta sold and bought in supermarkets. A further difficulty of assessment also arises from the absence of both formal and official practical verification, and the possibility of intervention, not recognized for students (except for episodes of ad personam protest), or for families (whose role is limited to the participation at two class board a year, and may fear reprisal should they express doubts on the quality of the work performed by a teacher), nor for colleagues (except for meeting held for assigning grades), nor for the headmaster, nor for the Regional management. Each check is therefore completely informal, all is about oral transmission of information and rumours, and any sanction can only be based on the reputational mechanism which can result ineffective if the teacher is particularly and permanently unable or unwilling to teach efficiently. In Italy, even the headmaster has no real power in terms of rewards or sanctions over the staff whose work he/she is responsible for- or, better, would be responsible if, in turn, he/she were subject to the incentive/sanction mechanisms, such as those that in the market industries
claim successes or failures to managers. In any case, the headmaster carries out an important function whenever he/she manages to create (or strengthen) a spirit of cohesion among the teachers of the school he/she is responsible for, as well as the dialogue between them, this is one of the sine qua non condition for the implementation of innovation and a climate of mutual esteem based on shared objectives. Therefore, the final aim of our work will demonstrate that the lack of school evaluation results so that they are comparable between classes and schools prevents providing reliable information to families as well as directing the incentives of students and teachers. The assessment of school results can also be used as a basis for the introduction of a teacher performance-related pay system or possibly class boards. Of course, it is not possible to assess reliably and objectively each teacher's contribution. However, this is conceivable for the class board, in order to encourage cooperative learning among teachers as well. Since each student gets in contact with many teachers throughout his/her course of studies and since learning is a cumulative process, it is difficult to assess straightly the effectiveness of the work of a single teacher. Perhaps it is possible to devise a grid where objectives and/or assessable items within the education and training process of each student and class could be taken into account.

Fiorella Baldo, teacher of Literature at the "G. Lombardo Radice" high school in Catania since the s.y. 1997-98. Collaborator of the Headmaster,she is the contact person of INVALSI, RAV, POF/PTOF, PdM, BS. She deals with the internal and external evaluation of the Institute by sharing the results of the analyzed data with colleagues.

Angela Maria Giuliano, lecturer in Literature at the "G. Lombardo Radice" high school in Catania since the s.y. 2003-04. Collaborator of the Headmaster, she is the contact person of INVALSI, RAV, POF/PTOF, PdM, BS. She deals with the internal and external evaluation of the Institute by sharing the results of the analyzed data with colleagues.

Some reflections on the transformations of the didactic setting Gianluca Valle

Introduction. My contribution intends to deepen the role of the teacher within the DDI, which has been used more or less heavily in recent times, due to the current health emergency. This role will be taken into consideration in relation to the different modalities of interaction that the DDI allows to establish with students, to the revision of learning objectives and to the evaluation of school results.

Research subject and hypothesis. The experience I gained together with my high school students during the lockdown and in the first months of this school year, organized in blended mode (half class in presence, half remotely), led me to develop some pedagogical and didactical reflections around two main concepts: presence and evaluation. As for the first core, the use of DDI required the redefinition and remodeling of the "presence" of teachers and students within the teaching setting. Some questions become urgent: what impact does the physical-bodily presence have in the learning processes? Does DDI, by minimizing the nonverbal factors of communication (from gestures to proxemics), eliminate or modify the role of the teacher? On the one hand, as is evident, physical presence is not enough to have effective learning; on the other hand, the immaterial presence of the teacher and students on the screen significantly affects their interaction. Which is the difference between "embodied" and "disembodied" presence? How to promote and build participatory lessons even in a regime of "disembodied" presence? How to do it, moreover, if the school organization requires teaching in presence and distance in synchronous mode? These, and other questions, make it necessary to rethink the concept of presence, and consequently that of distance, which must not necessarily be considered as opposites, but more advantageously as complementary. In other words, being present does not just mean "being there in front", like passive receptors, but being intentionally and attentively present. It follows a reconsideration of the strategies and methods of attention, which can exploit the results matured in the field of different knowledge, such as psychoanalysis and phenomenological pedagogy: the first for the notion of floating attention and the second for the crucial notion of motivation. The restructuring of the didactic setting, of its times and spaces, reverberates on the definition of evaluation, which must cease to be instantaneous and punctual and instead become procedural and personalized. In

this framework, which the DDI has made it possible to highlight even more, evaluation appears immanent to the teaching / learning process and constitutes its "intelligent" moment. This process always begins with an evaluation act: "What do my students know or know how to do? What do they need to learn new and better? What knowledge and skills are useful for facing new learning? ». Competence as "acting knowledge" does not exist by itself, while there is the person who mobilizes knowledge and skills in the face of problems to be solved and concrete situations to manage.

Data used. Bibliographic research and the study of materials related to different disciplines (in particular, pedagogy, teaching, docimology), also in the international context, for the definition of some key concepts, such as competence, evaluation, a distance teaching and integrated digital teaching. This preliminary study had the function of selecting the transversal skills and learning objectives on which I focused my teaching activity and of defining the evaluation rubrics necessary to record their achievement. A selection of products made by my students during the lockdown. The evaluation rubrics developed for the evaluation of my students (about a hundred) in the second period of the academic year 2019-20.

Method. The method followed is that of the historical-critical investigation of the sources, in a first phase. After defining the objectives, I made use of participant observation and recorded the evidence, using the evaluation rubrics constructed for this purpose.

Results. The teacher is a cultural and emotional leader, who must provide frames of meaning to learning activities. His speech unfolds around three fundamental directions: the construction of the relationship and an atmosphere of resonance, the narrative support for students' motivation, the evaluation of their acts of understanding. Evaluation is a complex, systematic and continuous process, which has the function of enhancing - in the sense to the scholastic and experiential path of the students, considering their progress and regresses with respect to the objectives. There is therefore no zero degree of competence, especially if we refer to European key competences. Levels are used to describe the growing complexity of mastery of skills: from an embryonic level, made up of limited knowledge, simple and executive skills, with reduced autonomy, one arrives at higher levels in all dimensions.

Gianluca Valle, is a teacher of Philosophy and Human Sciences at the Liceo Gelasio Caetani in Rome. Laurea in Philosophy from the University of Pisa (110 cum laude). PhD in Philosophy at the International School of Advanced Studies of the Collegio San Carlo of Modena (summa cum laude). Translator from French and German of human sciences essays. Author of numerous essays and curatorship in the philosophical and pedagogical area. Theatrical critic for the magazine Persinsala.it. Member of the Clinamen-Psychoanalytic Research Association. He held the position of coordinator of the Department of Human Sciences numerous times, where he promoted the planning of teaching by skills, preparing reflection documents on the key competences of the Recommendation of the Council of Europe. In the s.y. 2018-19 and 2019-20 he participated in the drafting of the Improvement Plan and the Institute's Self-Assessment Report. In the s. y. 2019-20 he coordinated the Nucleo Interno di Valutazione and I was the drafter of the Social Reporting document on the SNV-MIUR platform.

How students live Mathematics: the point of view of teachers Michela Freddano - Ivan Graziani - Stefano Babini

Mathematics is one of the four so-called STEM disciplines (with science, technology and engineering) and, in this sense, it is recognised as relevant for the economic growth and professional development of the future. From the national point of view, the INVALSI theoretical framework of Maths takes into account aspects from the National Indications and Guidelines. Some examples are modelling and applications for reading, interpreting and solving problems of everyday life; internal development, reflection and speculation on the cultural products of mathematical activity; suggesting to refer to fields of student experience to give meaning to mathematical objects (INVALSI, 2018). That definition is coherent with that of mathematical literacy in the OECD's Programme for the International Student Assessment, which refers to students' ability to formulate, use and interpret Mathematics in a variety of contexts, including

mathematical reasoning and the use of mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena (INVALSI, 2019).

In this sense, Mathematics is a basic discipline but often difficult for students and not only, to the point of becoming a reason for "choices by exclusion" into the passage from one school cycle to another (Baccaglini and Zan, 2018).

Starting from this consideration, in the school year 2018-2019 we carried out a survey that involved 1,726 students from some schools of the Emilia-Romagna region, of different order (primary, middle and high schools) and, at the secondary school, of different type (lyceums, technical and professional). The aim of this study was to know the progressive vision of students of Mathematics and, in particular, to know their attitudes towards Mathematics; to investigate if and how their vision of Mathematics evolves during the course of studies and to try to hypothesise some causes; to study this vision from a gender perspective (Freddano, Graziani, Babini, in press). Results show a generalised pleasure for Mathematics. At the same time, results underline that students' attitudes towards Mathematics seem to change between different school orders and types. Progressively, the joy and the enjoyment of doing Maths seem to decrease, while anxiety, fear and boredom increase. Significant differences also emerge between students from different types of secondary schools, while gender differences seem to be significant only for students from middle schools.

One of the hypotheses put forward is that of a Pygmalion effect (Jacobson and Rosenthal, 1972), i.e. the possible existence of a link between teachers' expectations of success in Mathematics towards students and their attitude towards Mathematics. In other words, the teacher, by relating to the students as he sees them and has imagined them, would also condition them in their actual performance.

Starting from these premises, this work aims to know what the teachers' opinion on how students live Mathematics is.

To this end, a survey has been organised for teachers by administrating an online questionnaire containing the same four questions of the student questionnaire which was administered to the students the school year before, an open question on gender differences and ten sociographic questions.

The survey, launched in September 2020, is currently underway. The sample of teachers was realised by the avalanche sampling technique from teachers of different order and types of schools throughout Italy and currently consists of 650 respondents.

With this research, we have asked teachers questions, building on those addressed to students last year, to see what the teachers' opinions are on the didactic, emotional and scholastic dimensions with which students live Mathematics. Legislative Decree no. 62 of 13 April 2017 introduced important changes in the assessment of students, also involving the INVALSI tests, partly modifying the structure and the relationship with the concluding State exams of the first and second cycle of education. The student needs to be at the centre of his or her learning process. Evaluation needs to have "a formative and educational purpose and contribute to the improvement of learning and to the training success of students; it documents the development of personal identity and promotes the self-evaluation of each person in relation to the acquisition towards a commitment to training success and to the achievement of consolidated and deep competences, necessary to face trials of any kind and above all the world of work.

Michela Freddano, is head of the School Evaluation Area at INVALSI, where she has been a researcher since 2013. PhD in Evaluation of processes and educational systems, she is contract professor of Action Research Methodology. Clinical interview and interview in organizational contexts at the Telematic University of IUL. *Ivan Graziani,* teaches Mathematics and Science. Trainer in Mathematics didactics. Passionate about ICT, problem solving and didactic communication. He is part of the "Research and Experimentation Group in Didactics of Mathematics" (GRSDM) of the University of Pisa" and of the research group "Divertical-Math". She collaborates with UNIBO, INDIRE and INVALSI and with Mondadori-Rizzoli education.

Stefano Babini, teaches Mathematics and Physics. Passionate about problem solving, didactic communication and new technologies applied to didactics. He deals with learning and evaluation processes in various training and system contexts. He is part of the research group in Mathematics didactics "Divertical-Math". He has been collaborating with INVALSI for years.

THEME 1. INEQUALITY SITUATIONS AT SCHOOL: DETECTION METHODS AND BEST PRACTICES

FOR THE SOLUTION

ORGANIZER: ESPANET- INVALSI Coordinator: Emmanuele Pavolini February 26th: 08.30-10.30 {Room Maria Gaetana Agnesi – Research 6}

Distance teaching and prevention of school drop-out: a survey in the city of Palermo during the lockdown for Covid-19 Liliana Leone - Lino D'Andrea

Introduction. The gaps in the areas of Southern Italy regarding inadequate levels of knowledge are well known, as well as the deep connections between poverty, early educational failure and implicit and explicit school dropout (MIUR, 2019; Ricci, 2019; Rossi-Doria, 2016). Sicily is the region with the highest percentage of overall school dropouts in the first level of secondary education (1.2% against 0.7% in Italy). In some districts of the city of Palermo, 16.2% of residents are affected by the non-completion of upper secondary school (MIUR DGCASIS, 2019; MIUR USR Sicilia, 2018:83). To date, the research work has been focused on individual large cities and border areas concerning the use of information and communication technologies (ICT) for distance learning (DL) during the Covid-19 crisis and the risks of widening previous inequalities. Several studies and recent monitoring have highlighted such widening due to lack of devices, lack of access to the network, overcrowding of homes, but also the presence of positive aspects related to a greater customization of teaching methodologies (Barca and Luongo 2020; MIUR 2020; Pellegrini and Maltinti, 2020; Livari, Sharmaa and Ventä-Olkkonen, 2020; Mosa, 2020; AlmaDiploma, 2020).

Research object and hypothesis. The purpose was to identify the responses and good practices developed by the Istituti Comprensivi Statali (ICS) of Palermo, in collaboration with the educational communities, in the management of the DL in the lockdown phase. The focus was on organisational and educational changes, collaboration networks, the use of digital teaching methodologies and 'open school' models. The assumptions were that: (a) innovation and adaptation capacities are strongly mediated by the managerial style of management; (b) the 'open school' strategies developed over the years influence school performance and the ability to adopt solutions to reduce inequalities due to the socio-economic and cultural disadvantage of the families; (c) in a period of severe crisis an organisation can mobilise new energy, develop greater cohesion and be prepared to introduce innovation and change by overcoming resistance and obstacles.

Data used. The study used a mix of sources: (1) semi-structured interviews with ICS Managers; (2) indicators taken from ICS RAV 2018-2019 and in particular from the sections: 1.3.d equipment and infrastructure (e.g.: 1.3.d.5- % PC and Tablet in laboratories); 1.4 - Professional resources; 2.1 - School results; 2.2 - Results in national standardized tests (e.g. Indicator 2.2.b.2 Variability of TRA class scores -; 2.2.a.5 % of students on 1st level of learning) as well as some data taken from POFs; (3) monitoring documents and reports produced by the ICS and provided by the Observatory for School Dispersion of the USR Sicilian Region and Province of Palermo.

Method and sample. The survey promoted by the Guarantor for Children and Adolescents of the Palermo Municipality was carried out in the period Jun-Sept 2020 through semi-structured remote audio-video interviews with the managers of large ICS in the city of Palermo. The sample of the 12 ICS involved in the survey (25% of those present in the city) involves 10,680 pupils, 2,369 teachers and 68 school plexuses distributed over 7 of the 8 districts. The selection criteria for the ICSs were: a) diversification of the territories; b) presence of the different school orders: Childhood, Primary,Low Secondary. The areas that were discussed in detail in the interview were: A) The impact of the pandemic on teaching, the adoption or implementation of the use of digital platforms for the DL (e.g. G-Suite for Education, Zoom, Edmodo, Fidenia etc.); B) Distance working methods between teaching staff and between teacher-student families; C) Open school and relations with the community; D) Planning (e.g. POF) for the 2020-2021 academic year. The interviews have been completely transcribed and the contents have been codified. A database has also been created that includes indicators and data in the RAV.

Results. A connection emerges between socio-economic characteristics of the contexts (ICS and single plexuses) and effective management of the lockdown phase as full and rapid adoption of platforms for the digitisation of administrative processes and the implementation of the DL, containment of school drop-out, involvement of families and pupils and activation of synergies with the EELL and territorial networks (e.g. for the provision of digital devices or the organisation of support activities aimed at families). Two factors play a key role: 1) a strong activation of the school managers; 2) the digital infrastructure of the Institutes and pre-existing 'open school' models. Overall, the cohesion of the teaching staff and ATA has been strengthened, with significant efforts for the inclusion of all pupils and actions aimed at the involvement of mothers also in areas of greater distress. Among the technical limitations is the massive use of smartphones. There has been a sort of re-discovery by the school world of the role of cognitive styles in learning processes and of the potential of digital didactics, which has given results considered surprising with several pupils at risk of dropping out and sometimes with pupils with BES. The crisis has represented a powerful experience that has challenged previous organisational routines and offered indications for the governance of educational policies at a city level with the signing of specific Educational Community Pacts and the activation of Educational Committees at a district level (Del.Comune di Palermo, n.141 22-6-2020).

Liliana Leone, Director of the CEVAS research centre (www.cevas.it) has worked on educational policies and for the evaluation of national programmes to combat poverty and for the promotion of human and economic development. Author of numerous texts including: "Measures to combat poverty and conditionality" for Franco Angeli, 2017.

Lino D'Andrea, is Guarantor for Childhood and Adolescence of the Municipality of Palermo. He has held numerous positions at national level and collaborated as an expert with many bodies including: the National Observatory for Children's Rights, Unicef Italia, CRC Group for the monitoring of the Convention on the Rights of the Child in Italy.

The Covid-19 School Closure and Math Learning Inequalities in Primary School in the Torino Province (MATGAP) Lucia Schiavon and co-author

Introduction. Because of the Covid-19 virus, Italian schools have been locked down since February 24, 2020 and school learning has been replaced, when feasible, by distance education. There are important reasons to be concerned about detrimental effects of such school closures on learning outcomes, in particular for disadvantaged students. The Education Endowment Foundation (2020) claims that the attainment gap between disadvantaged children and their peers may widen by 36% when pupils return to school. The European Commission suggests that the increased disparity in cognitive and non-cognitive skills, which is likely to have happened during the Covid-19 pandemic, may have consequences in both short and long-term (Di Pietro et al., 2020). Moreover, for the first time since the concept was developed, the United Nations Development Programme expects a steep reduction in human development in 2020 due to reduced economic activity and a reduction in educational attainments (UNDP, 2020). There is an urgent need for assessment for the learning loss of pupils in primary schools, in order to define well-informed policy actions that can mitigate the impact of the pandemic (DELVE Initiative, 2020). Yet, there is no solid quantitative evidence of the effect of school closure on learning losses in Italy.

Research question. The aim of the project is to measure the effect of the Covid-19 school closures on Math skills, with special attention to those children with a disadvantaged background. We decide to focus on the loss on competencies in Math since there is evidence that time spent in school reduces inequalities particularly in Math (Battistin and Meroni 2016; Marcotte, 2007), and to take advantage of the data, and experiences gained from a previous project implemented in 25 schools in Turin province (Tackling the Gender Gap in Mathematics in Torino Province, GGM, Di Tommaso et al., 2020).

Data. In order to perform the empirical analysis, we use data collected by the researchers and data from the INVALSI dataset regarding two sample of pupils: the first group is composed of all children participating in the GGM project mentioned earlier, who attended grade 3 in 2018-19 (n=1,200 children); the second one is

composed of all children attending Grade 3 in the same schools in 2019-20 (n= 1,200 children). As it regards the two groups of pupils, we consider their results at INVALSI Math's test in II° Grade (respectively in 2018 and in 2019), as well as the results at the GGM test a year later. The "GGM test" is a test on Math skills designed by the research team as part of the GGM project. The test has been designed to be comparable with the INVALSI national standardized test taken by the children in Grade 2 and has been validated as such by an external expert. The GGM test was administered at the end of the third Grade (spring 2019) for the first group and at the beginning of the fourth Grade (fall 2020) for the second group. Although the second group took the test at the beginning of the fourth Grade, we expect that their level of mathematical skills is comparable to that achieved at the end of the third grade, and it certainly accumulated "learning delays" compared to the first group. The marking of the GGM test administered to the second group is currently in progress.

Empirical Strategy. We estimate the loss of Math competency in primary school due to the lockdown using a difference-in-differences approach, comparing the change between Grades 2 and 3 in a treatment group (hit by the lockdown) and a control group (not hit by the lockdown at the same age). The control group is composed of the children participating in the GGM project who attended Grade 3 in 2018-19. The treatment group is composed of all children attending Grade 3 in the same schools in 2019-20. The change in Math competency for both groups are evaluated by comparing the results of the INVALSI test in Grade 2 and the GGM-designed test taken a year later. We identify the effects of Covid-19 by comparing the changes in Math scores for the treated and the control group, controlling for background information (age, gender, parental education and migrant status) and taking into account school fixed effects. This will also make it possible to look at how educational inequality has changed, a necessary pre-requisite for designing an effective intervention to mitigate losses in Math competency.

Lucia Schiavon, is research fellow in Economics at the University of Turin, and research Affiliate at CHILD Collegio Carlo Alberto. Her research interests are on health, education, family economics and on impact evaluation of social policies.

The INVALSI data: a source to analyze Italian digital divide Lorenzo Maraviglia

The Covid-19 epidemic has dramatically drawn attention about the deep inequalities in terms of access to digital resources that still plague our country. In particular, the seriousness of the digital divide has emerged with special intensity and gravity in connection to the outcomes of distance learning (DDI). Moreover, the condition of young people without access to the internet and/or to the skills and resources to take advantage from DDI is indicative of the difficulties and backwardness in which many families still find themselves. The INVALSI data, once integrated with other statistical sources (e.g. the micro-data of the Survey on the Aspects of Daily Life of ISTAT) and administrative (e.g. the open data of MIUR), allow to deepen the knowledge of the dimensions of the digital divide; above all, thanks to their territorial detail, they allow a reconstruction of the geographical variability of the phenomenon, providing an important tool in support of the action carried out by local and central administrations to reduce the opportunity gap. This contribution illustrates these cognitive and practical possibilities, with specific attention to the needs of territorial governance systems.

Lorenzo Maraviglia, he attained a PH. D. in Sociology of Development at the University of Pisa. He manages the Statistical Office of the Provincia di Lucca and he is a member of ISTAT technical committee for the development of statistics in local organizations (municipalities etc.). He teachs Social Research at the University of Pisa and do research on issues such as school dropout, immigration, labour market and volunteering.

The Geography of Educational inequalities in Italy: Mapping territorial variations in INVALSI test by parental education Risto Conte Keivabu - Fabrizio Bernardi

Introduction. Recent years have witnessed renewed interest in the geography of intergenerational socialeconomic mobility, both in Sociology and Economics (Bell, Blundell and Machin, 2018; Chetty et al., 2014; Donnelly et al., 2017; Manduca and Sampson, 2019; Sharkey and Faber, 2014). These studies show to what extent the place of birth and residence in the first years of life can moderate or strengthen the association between social origins and future socio-economic outcomes. Moreover, being born in a wealthy family might compensate for the unfortunate effects of living in a poor area. Conversely, low socioeconomic status might have a multiplicative effect enhancing the (dis)advantages determined by geography.

Objective and Research questions. In this paper we undertake an analysis of the geography of educational inequalities in Italy and investigate in which provinces social background inequality in test score outcomes are larger. We consider two indicators of social background inequality in test scores. We focus on differences across Italian provinces in test score elasticities by social origins and on the chances of success of the most socio-economically disadvantaged children. These two indicators of social background inequality relate to different notions of social justice (Kangas, 2000). More specifically we address four broad research questions: 1) In which provinces is the social origin gradient in test score results larger and smaller? 2) How does being born to a disadvantaged family located and living in a given province affect individual chances of climbing to an adequate level of educational achievement? These two research questions refer to the intersection of geographical and social origins inequalities changed over time (from 2013 to 2019, admittedly a short period)? 4) Do geographical differences in social background inequalities in test score results vary at different educational grades, i.e. from 2nd to 5th and 8th Grade? With the latter two questions we investigate whether the geography of social origins inequality has become more salient over time and at different point of the educational trajectories.

Data and Variables. For the analysis we use the administrative INVALSI data for the years between 2013 and 2019.We focus on tests results in the 2nd, 5th and 8th Grade. We define social origins using mother's educational level and use Math scores corrected for cheating to measure students' competences. In the analysis of the success chances of the most disadvantaged students we define them as those in the bottom 20% quintile of the mother's educational distribution. Since mother's educational level is a categorical variable, we use the method proposed by Reardon (2018) to transform it into percentiles and then identify the bottom 20% quintile. We define adequate achievement as being at or above the median of the standardized score corrected for cheating for the Math test. We create a binary variable (0-1) with value 1 indicating that a student reached a level that is equal or higher than the median.

Method. In the analysis of test score elasticities we estimate an OLS regression of Math test scores on parental SES for each province. Consequently, we define the success rate of the most disadvantaged students (those in the bottom 20% quintile of the maternal education distribution) estimating the percentage that reached the median national level in each province, year and Grade of interest. To answer the questions on variation over time and educational grades, we calculate the standard deviation for the distribution of the success rates of the most disadvantaged students by province in each year between 2013 to 2019 and in the corresponding distribution for the 2nd 5th and 8th Grade, for the cohort that entered in 2nd Grade in 2013. This approach is inspired by the economic literature interested in the measurement of convergence (Barro, 1992; Montero-Granados et al., 2007).

Preliminary results. We observe that there are stark regional differences in the success rate of the bottom 20% in 2018. For example, a vulnerable student in the province of Cuneo, in the region Piemonte, located in the west part of Italy, has good chances (65%) to reach a level that is higher than the median. Conversely, in Palermo a low SES background gives small chances (29%) to reach a proficiency in Math that is equal or superior to the median. Consequently, we plot the standard deviation from 2013 to 2019 in the rate of success in Math of students between provinces taking the 8th Grade INVALSI test. The results show a negative correlation suggesting a convergence between provinces and a reduction in inequalities over time. However, results are also driven by scores in 2018 and 2019 years in which a new type of INVALSI test has

been introduced that might explain results. Finally, we observe the cohort of students born in 2005 that took the test INVALSI in 2nd, 5th and 8th Grade respectively in 2013, 2016 and 2019. Over time the standard deviation between provinces in the same cohort of students diminishes. Therefore, we observe convergence. Possibly, schools manage to partly decrease differences that are present early in life reducing inequalities from 2nd to 8th Grade.

Following analysis. In the next analyses we will estimate OLS regressions to extract the elasticities in test score by social origins for each province, year and Grade. We will then compute whether the standard deviations of the provincial distribution vary by years and Grades. We will also explore the possibility to estimate that account for spatial autocorrelation.

Risto Conte Keivabu, is a PhD student at the Social and Political Science department of the European University Institute. He received a BA in Political Science at the University of Padua in 2016 and an MA in public policy at the Southern Denmark University in 2018.

Fabrizio Bernardi, is full professor of Sociology at the European University Institute (EUI), at Fiesole (Fi). He received his Phd in Sociology and social research from the University of Trento. He has taught at the faculty of Sociology of the University of Bielefeld, Germany, as assistant professor, from 1998 to 2001 and at the UNED, Spain, as assistant and then as associate professor, from 2001 to 2010.

THEME 5. MODELS AND METHODS APPLIED TO INVALSI DATA Organizer: INVALSI Coordinator: Daniele Vidoni February 26th: 08.30-10.30 {Room Laura Bassi - Research 7}

STEM degrees and students' mathematical and scientific skills Barbara Baldazzi

STEM degree programs are related to engineering, geo-biological, architecture, scientific and chemicalpharmaceutical disciplines. STEM graduates in 2017 make up 26.5% of graduates for the whole year (about 276 thousand). The data show a different composition by gender: among STEM graduates the male component is higher, reaching 59.0%, while among non-STEM graduates women prevail (they are almost two out of three) (source: Almalaurea). Focusing attention on the choice of the university study direction become important for the study of differences observed in the employment rates of graduates by subject area. In 2019, the employment rate of the graduate population reaches the highest level for the medical and pharmaceutical area (86.8%), followed by degrees in science and technology, (STEM, 83.6%), those of the socio-economic and legal area degrees (81.2%) and finally the degrees of the humanistic and services area (76.7%) (source: ISTAT). In addition, the gender gap in employment returns is clearly against women, and remains high even among graduates in technical-scientific disciplines (STEM). Some questions are of interest: How much are the mathematical skills developed in the school an indication of future university choices? Why the best performance of female university students, which can also be seen for STEM degrees, do not lead to an effective and equal inclusion in the world of work? The combined use of data sources (MIUR data, Labour Force Survey and INVALSI data) will try to show how the secondary education, then tertiary, and ultimately the job of boys and girls are oriented.

Barbara Baldazzi, researcher of Socio-Demographic Statistics Area at ISTAT since 1997. Researcher in SDGs Project: "Sustainable Development Goals". The United Nations Statistics Division entrusted Istat with the task of coordinating the production of indicators for measuring sustainable development and monitoring its objectives. In particular, in this project, she deals with analyzing, proposing, improving and monitoring statistical measures on poverty and inequality (Goal 1 and Goal 10) and on education (Goal 4). Researcher in BES Project: "Measuring Equitable and Sustainable Well-being in Italy". In particular, she has the coordination and organization of activities of the thematic work groups of Economic Well-being, Policy and institutions and Education and Training. Project Manager of "Adult Education Survey" (2017 and 2012), in two waves of survey on households for study the participation of the adults at education and training during the life.

Do schools have the same probability of adding value to competencies possessed by their students at the entrance? Angela Martini - Chiara Sacco

Introduction. Since 2016 INVALSI returns to the schools their achievement tests results not only as observed scores but also as value-added scores (Martini 2018; 2019). A school value-added is the contribution of the school to its students' progress net of other variables affecting learning such as their socio-demographic features and their competencies at the entrance; in other words, value-added is the part of variance between schools that cannot be explained by student variables and consequently may be due to the processes implemented by the school. (Teddlie and Reynolds 2000; Grilli and Rampichini 2009). Value-added is a fundamental judgment parameter for school accountability and evaluation in order to avoid an unfair comparison between schools with very different intakes (OECD, 2008). After estimating for every

school, by a multilevel regression model, a value-added score in Italian language and Math, INVALSI divides the scores into five categories ordered from the lowest to the highest.

Research subject and hypothesis. Our paper aims to analyze the probability for a school to be in a certain value-added category in the last year of lower secondary school – which represents in Italy the conclusion of common compulsory education – in relation to the scores obtained by its students at the end of primary education in Italian language and Math INVALSI tests.

Data. The data used are the value-added scores of lower secondary schools in Italian language and Math INVALSI tests of the year 2019 and the scores obtained by the same students at the INVALSI tests three years earlier, at the end of primary education.

Method. In order to analyze the relation between the probability of a school to be in a certain value-added category and students prior attainment, we will exploit the logistic multinomial model that represents the generalization of the logistic regression model to a multiclass problem. The probability to belong to a specific value-added class will be studied for all the Italian territory and for the three geographical areas (North, Centre, South) into which the country is divided.

Results. We expect to measure how the probability of Italian lower secondary schools to be in a certain value-added category changes according to the students' prior attainment and the geographical area where the school is located.

Angela Martini, graduated in Philosophy and later in Experimental Psychology at the University of Padua. After working as a teacher and a principal, since 1999 she has been permanently dedicated to research in the field of students assessment and schools evaluation, comparison between educational systems and analysis of data from international surveys on learning levels. She collaborates with INVALSI to the construction of achievement standardized tests and to the analysis of their results. She is the author of numerous essays and articles published in Italian and foreign magazines.

Chiara Sacco, PhD in Statistical Methodology for Scientific Research, currently works at the INVALSI Research Institute as statistician. The main research interests are in the context of multivariate data analysis for high dimensional data with particular focus on dimension reduction strategies, model based clustering and latent variable models.

How much do Italian 15-years-olds' skills improve over one year of schooling? Francesco Avvisati - Nathan Viltard

Measuring the pace of learning – i.e. learning gains associated with one grade of schooling, or grade gain is not simple. Assessments administered to students of different grades need to be longitudinally linked, and testing conditions must remain consistent. Previous studies have quantified the grade gain based on longitudinally-linked assessments, within a single education system (Prenzel et al., 2006; Nagy et al., 2017; Andrabi et al., 2011; Chetty, Friedman and Rockoff, 2014; Kane and Staiger, 2008). Only a few studies have been able to compare the grade gain across countries, based on international assessments (Singh, 2019; Jones et al., 2014). This paper tries to address this gap by providing rigorous causal measures of the effect of an additional year-of-schooling and year-of-age on performance based on common metrics for reading, Mathematics and science learning established by the Programme for International Student Assessment (PISA). We quantify the learning gain that results from an additional year of schooling around the age of 15 in Italy, and explore how this learning gain compares to other countries and how it varies between Northern and Southern regions. We compare the results for Italy to those of over 30 countries, and use the results to compare the effectiveness of learning systems around the age of 15; to delimit the "learning loss" that can be attributed to school closures during the Covid-19 crisis; and to establish a benchmark for other performance differences observed in PISA, such as gender gaps, socio-economic gaps, or between-country differences. We combine PISA data for Italy (about 15-year-olds) with data about 14 and 16 years-old in Grade 10, collected as part of the Italian national extension of the PISA study to a Grade-based sample. We focus, in particular, on Grade repeaters (15-year-olds in Grade 9) and on students with an early-school starting age (15-year-olds in Grade 11), and compare them to 14 and 16 year olds in Grade 10. In order to

overcome the limitations of a cross-sectional design and to interpret our estimates as reflecting causality, we use matching methods (inverse-probability weighting). Results show that the Grade gain from Grade 10 to Grade 11 for students ahead of schedule is between 12 and 16 score points, depending on the subject; while the Grade gain from Grade 9 to Grade 10 for students one year behind schedule is around 25 score points in all three subjects. These estimates are broadly within the range of those found in other OECD countries, even though they are based on two rather a-typical subpopulations of students. We also find that Grade gains for students ahead of schedule may be larger in the North of Italy, compared to Southern region where more such students are found. We discuss the extent and direction of possible biases that may affect these estimates due to selection based on unobservables.

Francesco Avvisati, is Senior Survey Specialist (Chief Methodologist) in the Directorate for Education and Skills at the OECD.

Nathan Viltard, is a Master student at the Ecole Normale Supérieure in Paris.

The Eye-tracking and the INVALSI tests: an idiographic study on the resolution paths of mathematical tasks

Camilla Spagnolo - Roberto Capone - Christian Casalvieri - Alessandro Gambini

This research is part of a larger project conducted nationally whose first results were presented at national and international conferences "Data for Research IV" and "14th International Conference on Technology in Mathematics Teaching". Such project aims to investigate how some textual, grammatical and lexical aspects influence the understanding of a mathematical text. These studies belong to an international interdisciplinary research strand involving computer scientists, neurologists, biologists, sociologists and cognitive psychologists based on the fundamental assumption that the type of text affects a student's reading and, as a consequence, his or her performance. The literature shows how often, in the interpretation of isolated sentences or key words, the skills acquired through language training and the interpretation of texts are used in science as indications of procedures to be executed rather than as tools that represent or communicate information. Some features of mathematical language, such as syntactic structures, also contribute to the manifestation of these behaviours, so they require regular attention and monitoring. Specifically, this research has involved students from the High School of Forlì and students from the Universities of Bologna, the Free University of Bolzano, Rome La Sapienza and Salerno. The first phases of the research (involving high school students and future teachers of the Free University of Bozen/Bolzano) have highlighted the elements catalyzing students' attention during the resolution of mathematical questions (Capone et al., in press). This contribution will show the first results of the last phase of the research, which involves secondary school students in Grade 13 and first-year university students and consists of a first experimental part in which the students' solving processes during the resolution of mathematical questions were analyzed, followed by a second part of semi-structured interviews. In line with international research in Mathematics didactics, which highlights how crucial the transition between the end of the second cycle of education and university studies is for the future path of the students, the different resolution processes implemented by the students in the face of questions of the INVALSI Grade 13 tests or that inspire them both in terms of knowledge and skills investigated and in terms of their structure are analyzed and compared. Through the eye-tracking, the resolution processes are analyzed and, through the tracking of eye movements, observing on which parts of the text the students focus their attention, it is possible to have a picture of the visual paths and, therefore, to have indications on the resolution steps carried out. The first results of this experimental phase, within the framework of cognitive sciences, seem to confirm the results of the first phases. In detail, the visualizations of different types of questions (multiple-choice, true or false and open-ended questions) were compared and from the first results it seems to emerge that students, when answering the same question, both in open and closed form, focus their gaze and attention on different parts of the task and this proved to be a decisive factor in the heuristics of the solving process. It also emerged that, as far as closed-ended questions are concerned,

focusing mainly on the answer options and the choice to proceed by "exclusion" frequently led to the wrong answer. In general, the questions in the interviews allowed the students to recognize their mistakes and, in some cases, to make them aware of how much they focused their attention on textual and structural elements irrelevant to the resolution. The students themselves recognized how their attention is often catalyzed by elements that are unnecessary for the resolution process. The data from this research are in addition to other evidence from previous experiments that have allowed us to outline a broader design into which this experimental study is inserted.

Camilla Spagnolo, research fellow in MAT04 at the Free University of Bolzano. Her main research interests concern argumentation processes in Mathematics, competence teaching and teacher training. She is an adjunct professor at the University of Urbino and tutor at the University of Bologna. She is involved in teacher training courses aimed at all school levels

Roberto Capone is Mathematics teacher, previously research fellow in Mathematics Education at the Mathematics Department of the University of Salerno, where he still teaches Calculus. His main research interests are in competence teaching, interdisciplinarity and innovative teaching methods for the teaching of Mathematics.

Christian Casalvieri has a degree in Physics and is currently a PhD student in Mathematical Models for Engineering, Electromagnetics and Nanosciences. He has been an adjunct professor of Mathematical Analysis at the Faculty of Civil and Industrial Engineering of "Sapienza" University of Rome since October 2010. He has always been interested in Mathematics teaching problems, especially in the transition from secondary school to the first university courses of scientific faculties. He is the creator and manager of the database of questions assigned to EOA (Educational Obligations Additional) and is responsible and selector of the Mathematics Advanced Course tests for the Faculty of Civil and Industrial Engineering.

Alessandro Gambini, PhD in Mathematics with thesis in Analytical Theory of Numbers, has been working for years in the field of Mathematics. He is Associate Professor at "Sapienza" University of Rome and deals with standardized assessments and the use of non-Euclidean geometries in teaching.

THEME 1. INEQUALITY SITUATIONS AT SCHOOL: DETECTION METHODS AND BEST PRACTICES FOR THE SOLUTION

Organizer: ESPANET- INVALSI Coordinator: Emmanuele Pavolini February 26th: 16.15 - 18.30 {Room Federico Caffè - Research 8}

Ethnic concentration and diversity in Italian primary schools Emanuele Fedeli - Moris Triventi

A strong relation between students' social origin and their educational attainment challenges educational systems, both in terms of their equity and efficiency. First, a society in which the socioeconomic background is a strong predictor of educational outcomes may be considered to be unfair. Second, a society characterized by a low level of social mobility, discriminating against competent and hard-working students from economically disadvantaged families misallocates human capital investment. While for a long time social scientists have analysed educational attainment as the main outcome, the increasing importance of human capital in contemporary economies led researchers to focus also on more direct measures of individuals' competencies. Today, the availability of data sources with standardized measures of pupils' scholastic performance allows to investigate how students' competencies are shaped by a set of individual and contextual characteristics. A first research stream investigates how students' achievement is affected by socio-economic resources of the family of origin. Empirical evidence, both at the international level (OECD, 2018) and in Italy (INVALSI, 2019) reports that social origin is strongly associated to children's competencies in key subjects, both at the mean and along the distribution (Giambona and Porcu, 2015; Costanzo and Desimoni, 2007), that these differentials start early in life and continue to be substantially strong also in upper secondary school and during young adulthood (Dammrich and Triventi, 2018). A second line of inquiry examined how student performance varies across geographical areas, reporting large heterogeneity in test scores across Italian regions (Bratti, Checchi, and Filippin, 2007; Agasisti and Cordero-Ferrera, 2013; Argentin and Triventi, 2015) and educational standards across schools (Argentin et al., 2017), usually favouring the North.

With this work we aim to develop a bridge between these two research streams, which, so far, have been rather detached from each other. Namely, we analyse whether the role of social background is similar or systematically varies across geographical areas. This allows us to establish whether not only the effectiveness of education differs across Italian regions but also whether inequality of opportunity related to parents' socioeconomic resources is heterogeneous across territories. A second contribution of our work consists in adopting a machine learning approach to shed light on the role of students' socioeconomic conditions on student achievement in Italy, which has interesting potentials in the study of educational inequality but it has not been widely applied (Masci, Johnes and Agasisti, 2018). Third, we provide a more in-depth investigation of which kinds of family socio-economic resources are more predictive of student achievement.

We use data from INVALSI-SNV, which monitors students' competencies in Italian language and Mathematics across key school grades. In this work, we put together data on the 5th grade (end of elementary school) from 2012 to 2018. By exploiting the large size of the INVALSI dataset, we are in the position to disaggregate the analysis by provinces, thereby gaining a more fine-grained perspective on territorial heterogeneity in educational inequality. Moreover, contrary to what is done in the larger part of the analysis of the INVALSI data we do not focus on the summary index of economic, social and cultural status (ESCS) (Campodifiori, Figura, Papini and Ricci, 2010). Indeed, by applying machine learning algorithms we are able to consider all items contained in students' questionnaires about parental education, parental occupation, and home educational resources without risk of overfitting the data.

Albeit our analysis is descriptive, it allows us to learn from the data what is the most predictive model specification, that is the specification that minimizes out-of-sample prediction error. Note also that, embracing a data-driven approach implies becoming agnostic about the data generating process and this

has two important consequences: i) algorithms may select different models across provinces, ii) the level of uncertainty of estimates take into account both missing information and the uncertainty about the "true" model.

The analysis begins with a regularization of linear regression (Zu and Hastie, 2005; Meinshausen, 2007) and proceed with machine learning algorithms of increasing complexity (Hastie et al., 2009). The possibility of a highly non-linear data generating process will be considered by using conditional inference regression trees and forests (Hothorn, Hornik and Zeileis, 2006). Finally, the possibility of extremely complex interactions between regressors will be modelled by adopting neural network (Günther and Fritsch, 2010). The most accurate model will be selected by k-fold cross-validation.

Our analysis aims at producing maps showing the heterogeneous magnitude of the effect of social background on students' outcomes across the Italian provinces, which will provide useful insights on which socioeconomic variables are more conducive to academic achievement and in which contexts (Gregorutti et al., 2017).

Emanuele Fedeli, is Postdoc Fellow at the University of Trento. His research agenda relies on an interplay between sociology and economics of education. In his Phd thesis, he explores the effects of classroom hierarchies and peers on beliefs, attitudes, socio-emotional skills, academic performances, and educational choices. Emanuele holds a Phd in Sociology and Social Research (University of Trento, Trento), an MRes in Public Policy and Social Change (Collegio Carlo Alberto, Turin), and an M.Sc. in Industrial Economics (LUISS University, Rome).

Moris Triventi, he is associate professor at the Department of Sociology and Social Research of the University of Trento (Italy). His research interests include social inequality, education, crime, and public policy evaluation. His works have been published in the Annual Review of Sociology, Policy Sciences, European Sociological Review and Studies in Higher Education.

Private and public high schools in Italy: INVALSI tests results and management bodies of the schools Angela Martini - Andrea Bendinelli

Introduction. Italy is one of the few countries where, on the basis of PISA surveys, private schools have worse performances than public schools (OECD, 2011; 2013). Generally speaking, private high schools in Italy seem to have a "remedial" role, considering that their enrolment is composed by less talented students from relatively rich family backgrounds in comparison with students attending public schools (Bertola et al., 2007; Bertola and Checchi, 2013). However, a recent study, based on the waves 2009, 2012 and 2015 of PISA tests scores, seem to indicate the existence of heterogeneous performances in the private sector depending on the type, confessional or not confessional, of the school (Checchi and Verzillo, 2017).

Research subject and hypothesis. Our paper has the following objectives: 1)to check the performance of private schools compared to public schools in the last four sessions of PISA (2009, 2012, 2015, 2018); 2) following the suggestion of the study by Checchi and Verzillo, to check the performance of public and private confessional and non-confessional schools drawing from results of the last INVALSI assessment (2019) of tenth grade students; 3) to analyze the features of students attending public schools, private confessional schools respectively; 4) to analyze how the difference in tests results between private confessional, private non-confessional and public schools varies when controlling for students variables, particularly their socio-economic status and their competencies at school entrance; Data The data used are the results of Italian language and Math tests of tenth Grade students together with the available information in the INVALSI dataset about their features.

Method. Comparative analysis; regression analysis.

Results. We expect that our work can confirm or disconfirm the hypothesis that confessional schools have better performances than non-confessional ones.

Angela Martini, graduated in Philosphy and later in Experimental Psychology at the University of Padua. After working as a teacher and a principal, since 1999 she has been permanently dedicated to research in the field of students assessment and schools evaluation, comparison between educational systems and analysis of data from international surveys on learning levels. She collaborates with INVALSI to the construction of achievement standardized tests and to the analysis of their results. She is the author of numerous essays and articles published in Italian and foreign magazines.

Andrea Bendinelli, got master degree in Statistics and works at INVALSI's statistical service. He carries out statistical analysis activities on large databases and conducts research activities in the assessment of students learning.

Do fiscal restraints harm test scores? Evidence from Italy Caterina Pavese - Enrico Rocco Rubolino

This paper provides regression discontinuity estimates of school spending on standardized test scores in Italy. Our empirical approach exploits cross-municipality differences in school expenditures generated by a discontinuity in eligibility forfiscal restraints. On average, school spending per-pupil is around 102 euros lower in municipalities subject to fiscal restraints. Using longitudinal data on pupils' attainment in national test administered by the Italian Institute for the Evaluation of the Educational System (INVALSI) at the beginning and the end of primary school, we find that spending differences lead to a gap in standardized test score gains of nearly 12 percent of a standard deviation. Taking advantage of unique teachers' questionnaire, we find that both the lack of several basic instructional tools and limited investments in school facilities explain most of the observed achievement gap.

Caterina Pavese, is a researcher at Ca' Foscari University of Venice. Her research interests focus on Economics of Education, Applied Microeconometrics and Labour Economics. She got her PhD in Economics from Ca' Foscari University of Venice in 2020 with a thesis on immigrant students and the determinants of their educational attainments.

Enrico Rubolino, is a PhD student in Economics at the University of Essex. He was a visiting student at UC Berkeley last year. His main research interests are in the field of i) public economics; ii) labor economics; iii) economic history. In 2018, his paper on tax-induced mobility in Italy was awarded the SIEP Prize.

Intercultural Competences for confronting inequalities and discrimination at school Agostino Portera

According to several empirical findings, in Italy and in most countries in the world school success is related to cultural differences. This presentation identifies strategies for confronting these inequalities and promoting achievement for all. For many years foreign students have shown higher failure rates and seem to struggle much more in school. The last INVALSI Report (2019) has confirmed that in all school grades, children with non-Italian citizenship score significantly lower in, both Italian language and in Mathematics, in comparison to Italian students. In addition, Pisa results identify educational inequities related to immigrant children. In Italy, 10% of students come from an immigrant background. Three in seven of these students are socio-economically disadvantaged and show low performance. Reading performance is especially low. Science and Mathematics performance is also problematic (OECD-Pisa, 2018). In order to address these inequalities linked to cultural differences, there is a growing need for Intercultural Competences (IC) at the cognitive, emotional and relational levels. Teachers need to be interculturally capable so that they can operate effectively in linguistically and culturally complex contexts (Deardorff, 2009; Council of Europe, 2014; Portera, 2014; UNESCO, 2015). This contribution includes: a) a comprehensive review of the major achievements and limitations of educational research on IC; b) a critical analysis of the pre-eminent models;and, an analysis of how to asses IC. In addition, it will c) present a model

of IC that is founded on extensive empirical research carried out by the Centre for Intercultural Studies in Verona (Portera, 2017).

Agostino Portera, Professor of Intercultural Education and Head of the Center for Intercultural Studies of the University of Verona (Italy). Director of the Master's program in "Intercultural Competences and Management". Professor Portera has published eleven books and several articles on immigration, identity, intercultural education and intercultural competence.

Ability composition in the class and the school performance of immigrant students Caterina Pavese - Elena Meschi

During the last decades, the rapid growth of immigrants in most European countries has called for investigation in many directions, ranging from the impact of immigrants on local labour markets (e.g., Dustmann et al., 2005), the educational systems of the host countries. In particular, a number of studies in the educational literature has investigated how immigrant children affect native children learning and achievements (among the others Frattini and Meschi, 2019; Ballatore et al., 2018; Tonello, 2016). In most European countries such interest has been motivated by the concerns that immigrant students may be detrimental to native students' attainments. On average, immigrant children are disadvantaged students coming from lower socio-economic backgrounds, learning in a new language and facing unfamiliar institutions. These hurdles commonly translate in large performance gaps.

In this paper, we challenge the existing approach of looking at the impact of immigrant children on native children's outcomes shifting the focus on how immigrant children are affected by their school environment and by the achievements of their native and immigrant peers. We build on the burgeoning literature of peer effects in education and investigate how and to what extent the ability of native and immigrant classmates affects their immigrant peers' educational outcomes. In particular, we estimate the impact of the average peer quality in the class and further investigate which part of the ability distribution of peers drives the effect, by looking at the role played by the extreme tails of the ability distribution. In other words, we ask whether is the average quality of peers that matters for immigrant students' achievement, or rather the presence of very good and very bad peers in the class.

Our empirical analysis is based on administrative data collected by the Italian National Institute for the Evaluation of the Education System (INVALSI) on two cohorts of students who completed lower secondary education in the academic years 2015-16 and 2016-17. The data at hand have a longitudinal structure so that we are able to track students over time and observe their prior achievements at the end of primary school.

The latter allows us to construct indicators of peer achievement in lower secondary schools based on predetermined measures of ability that are not simultaneously determined with students' own achievements.

Our identification strategy follows Lavy et al. (2012) and exploits the within-pupil across subjects variation in achievement, as a way to solve the non-random sorting of students across schools and classes, that may bias the estimation of peer effects.

Our study contributes to the existing literature along several dimensions. First, in contrast to the extant literature where the attention is drawn on the potential negative effect of immigrants on native learning and behaviour, we focus on understanding the peer effects mechanisms that affect immigrant children performance. Shifting the focus on immigrant children, we provide new insights on how class composition may help narrowing the gap between immigrant and native children improving immigrants' integration in the host countries school system, which is a timely question in all OECD countries given the sharp increase in migration pressure occurred in the last decade. Second, leveraging on the within-pupil across subjects variation and the longitudinal structure of the data, our identification strategy addresses some of the most severe problems in peer effects identification such as students' endogenous sorting and peer's ability measurement. Lastly, differently from Lavy et al. (2012) we are able to define the peers group very precisely thanks to the fact that our data provide class identifiers (rather than school identifiers). This unique feature allows us to draw a more accurate picture of students' interactions with respect to studies carried out at a broader level (i.e. using peers' measures at the school level) that might fail to capture some relevant

effect. 1. Our results suggest the basic but important finding that peer quality matters. In particular, peers' average ability has a positive and significant effect on both native and immigrant students. Additionally, we show that looking at the extreme tail of the ability distribution, native children are not affected by the quality of immigrant children and that peer effects are stronger within the same group than across groups, especially for native students. In other words, native students have a greater influence on native students than on immigrant students. For immigrant students this result is more nuanced but points in the same direction, particularly for children coming from a disadvantaged background. This evidence is in line with the findings in the literature on racial peer effects where the largest impacts are observed intra-race with little or no spillovers on the other racial groups (Fruehwirth, 2013; Hoxby, 2000).

Caterina Pavese, is a researcher at Ca' Foscari University of Venice. Her research interests focus on Economics of Education, Applied Microeconometrics and Labour Economics. She got her PhD in Economics from Ca' Foscari University of Venice in 2020 with a thesis on immigrant students and the determinants of their educational attainments.

Elena Meschi, is Associate Professor at the Department of Economics (DEMS), University of Milan Bicocca and Research Fellow at CefES. Her main research interests are in labour economics, education, trade and applied microeconometrics. Her work on these topics has been published in international journals, such as World Development, Labour Economics, Education Economics, Oxford Economic Papers, Economic Policy, Review of World Economics, Health Economics among others.

Territories and educational poverty: differences and characteristics in the Italian provinces Barbara Baldazzi

Every child and young person has the right to learn, train, develop his skills, competences and aspirations in the most profitable possible way and with the best opportunities; when this right is not guaranteed, the child finds himself in a condition of educational poverty, suffers from a lack of opportunity, which strongly and negatively affects his growth.

Moreover, educational poverty is a multidimensional phenomenon, which also involve other targets and objectives of the 2030 Agenda. The disadvantage of children and young people is often influenced by the socio-economic family situation, by material factors that penalize good growth, from inequality of opportunity that is perpetuated from generation to generation, in some places and some families.

The use of a heterogeneity of data sources allows to outline in the best possible way the characteristics of the territories with regard to educational poverty. The indicators of the Agenda 2030, of the BES of the territories, of the Labour Force Survey, the MIUR data and the INVALSI data on students' skills, calculated on the Italian provinces, will allow to outline a fairly exhaustive picture on children and youth opportunities, deprivations and outcomes to bring out territorial and socioeconomic inequalities, through the use of multivariate analysis models.

Barbara Baldazzi, is a researcher of Socio-Demographic Statistics Area at ISTAT since 1997. Researcher in SDGs Project: "Sustainable Development Goals". The United Nations Statistics Division entrusted Istat with the task of coordinating the production of indicators for measuring sustainable development and monitoring its objectives. In particular, in this project, I deal with analyzing, proposing, improving and monitoring statistical measures on poverty and inequality (Goal 1 and Goal 10) and on education (Goal 4). Researcher in BES Project: "Measuring Equitable and Sustainable Well-being in Italy". In particular, I have the coordination and organization of activities of the thematic work groups of Economic Well-being, Policy and institutions and Education and Training.

Project Manager of "Adult Education Survey" (2017 and 2012), in two waves of survey on households for study the participation of the adults at education and training during the life.

The influence of socio-economic-cultural background on academic results in the INVALSI tests of Italian and Mathematics in two southern regions: Puglia and Abruzzo Sergio Di Sano - Caterina Balenzano

Introduction. If we examine the INVALSI data, there are many factors that influence school results and, among these, an important role is played by students' socio-economic-cultural status (ESCS). The weight of this variable in the understanding of educational inequalities represented for a long time a classic theme of sociological analysis, in which different theories were compared (Besozzi, 2017). Such theme, which was focused also by school psychology, and specifically by the "Social Justice" perspective (Shriberg et al., 2013), constitutes a central issue to plan school policies.

Some recent contributions (Bagnarol and Donno, 2020; Russo et al., 2020), examining INVALSI English language test, underlined the importance of investigating the relationship between social stratification and territorial gaps, focusing attention on need to consider not only the North-South differences, but also those between individual regions or specific territories. As Russo et. al (2020) note: "... the distance between central-northern and southern students is smaller for socially advantaged students (high ESCS level), while it widens further down the steps of social stratification". (p. 22).

Consistently with some recent works focused on specific regions (e.g., Martini, 2020), the present study is aimed at investigating the relationship between ESCS and school results by comparing two regions: Puglia and Abruzzo. The interest of this comparison is linked to the fact that these two regions have different GDP, but the same relationship between GDP and learning outcomes; an average learning score that in both regions is slightly higher than what might be expected based on an estimate based on GDP.

Research subject and study's aims. The goal is to investigate the influence of the ESCS on school results in the INVALSI tests of Italian language and Mathematics, in two southern regions, Puglia and Abruzzo, examining how this influence changes based on several other variables; gender of the student, foreign origin, delay in studies, and class level socio-economic-cultural status (ESCS).

Data used. Data on learning outcomes (weighted score, based on Rasch's analysis) relating to the INVALSI tests of Italian language and Mathematics for lower secondary school (Grade 8) for the school year 2018-19 were used. The reason for this choice is linked to two types of factors: (a) in secondary schools Computer Based Tests are used which, unlike paper and pencil tests (used in primary school), are less influenced by the phenomenon of cheating; (b) compared to higher secondary school, there is the advantage of not having a differentiation by the type of school (high schools, vocational colleges and technical institutes), which is not easy to interpret.

Method. Different regression analysis models were compared to investigate how the influence of the ESCS on the scores in the Italian language regression tests change by introducing the other variables considered in this study. Specifically, we compared linear (OLS) regression and multiple linear regression (MLR) for both the regions, considering student's ESCS respectively as the one predictive variable or together with other variables.

Results. The results confirm the influence of the ESCS on school results in the INVALSI tests of Italian language and Mathematics but also the contribution of the other variables in modifying this influence. The comparison between the regression models and between the specific weights of the other predictive variables in the two compared regions was used to provide useful recommendations in defining different regional school policies. Therefore, results are discussed in the light of the need for differentiated guidelines for school policies in the two regions, in relation to their specificities.

Sergio Di Sano, PhD in Developmental Psychology, he is Assistant Professor of School Psychology at the University of Chieti-Pescara - Department of Neuroscience, Imaging and Clinical Sciences, and studies learning and adaptation processes in the school environment, with particular reference to reading skills and the school climate, collaborating with schools in improvement projects based on participatory research-action.

Caterina Balenzano, PhD in Psychology. She is Assistant Professor in General Sociology at the University of Bari - Department of Political Science and studies social protection and support policies, programs and

interventions aimed at vulnerable minors and families, including measures aimed at children and adolescents living in educational poverty and/or at risk of school dropout.

The roots of educational inequality in Italy: A machine learning approach to analyse geographical differences in the role of students' social background Moris Triventi - Paolo Brunori

A strong relation between students' social origin and their educational attainments challenges educational systems both in terms of their equity and efficiency. First, a society in which the socioeconomic background is a strong predictor of educational outcome may be considered unfair. Second, a society characterized by a low level of mobility, discriminating against competent and hard-working students from economically disadvantaged families, tends to misallocate human capital investment. While for long times social scientists have analysed educational attainment as key outcome, the increasing importance of human capital in contemporary economies led researchers to focus on more direct measures of individuals' competencies. Today, the availability of data sources with standardized measures of pupils' scholastic performance allows to investigate how students' competencies are shaped by a set of individual and contextual characteristics. A first research stream investigates how students' achievement is affected by socio-economic resources of the family of origin. Empirical evidence, both at the international level (OECD, 2018) and in Italy (INVALSI, 2019) reports that social origin is strongly associated to their competencies in key subjects, both at the mean and along the distribution (Giambona and Porcu 2015; Costanzo and Desimoni, 2007), that these differentials start early in life and continue to be substantially strong also in upper secondary school and during young adulthood (Dammrich and Triventi, 2018). A second line of inquiry examined how student performance varies across geographical areas, reporting large heterogeneity in test scores and educational standards across schools (Argentin et al., 2017) and across Italian regions (Bratti, Checchi and Filippin, 2007; Agasisti and Cordero-Ferrera, 2013; Argentin and Triventi, 2015), usually favouring the North.

With this work we aim to develop a bridge between these two research streams, which, so far, have been rather detached from each other. Namely, we analyse whether the role of social background is similar or systematically varies across geographical areas. This allows us to establish whether not only the effectiveness of education differs across Italian regions but also whether inequality of opportunity related to parents' socioeconomic resources is more or less pronounced in different contexts. A second contribution of our works relies in adopting a machine learning approach to shed light on the role of students' socioeconomic conditions on student achievement in Italy, which has interesting potentials in the study of educational inequality, but it is not widely applied yet (Masci, Johnes and Agasisti, 2018). Third, we provide a more in-depth investigation of which kinds of family socio-economic resources are more predictive of student achievement.

We use data from INVALSI-SNV, which monitors students' competencies in Italian language and Mathematics across key school grades. In this work, we put together data on the 5th Grade (end of elementary school) from 2012 to 2018. By exploiting the large size of the INVALSI dataset, we are in the position to disaggregate the analysis by provinces, thereby gaining a more fine-grained perspective on territorial heterogeneity in educational inequality. Moreover, contrary to what is done in the larger part of the analysis of the INVALSI data we do not focus on the summary index of economic, social and cultural status (ESCS) (Campodifiori, Figura, Papini and Ricci, 2010). Indeed, by applying machine learning algorithms we are able to consider all items contained in students' questionnaires about parental education, parental occupation, and home educational resources without risk of overfitting the data.

Albeit our analysis is descriptive, it allows us to learn from the data what is the most predictive model specification, that is the specification that minimizes out-of-sample prediction error. Note also that, embracing a data-driven approach implies becoming agnostic about the data generating process and this has two important consequences: i) algorithms may select different models across provinces, ii) the level of uncertainty of estimates take into account both missing information and the uncertainty about the "true" model.

The analysis relies on machine learning algorithms of increasing complexity (Hastie et al., 2009). Starting with a regularization of linear regression (Zu and Hastie, 2005; Meinshausen, 2007). The possibility of a highly non-linear data generating process will be considered by using conditional inference regression trees and forests (Hothorn, Hornik and Zeileis, 2006). Finally, the possibility of extremely complex interactions between regressors will be modelled by adopting neural network (Günther and Fritsch, 2010). The most accurate model will be selected by k-fold cross-validation.

Our analysis aims at producing maps showing the heterogeneous magnitude of the effect of social background on students' outcomes in the 107 Italian provinces, which will provide useful insights on which socioeconomic variables are more conducive to academic achievement and in which contexts (Gregorutti et al., 2017).

Moris Triventi, is associate professor at the Department of Sociology and Social Research of the University of Trento (Italy). His research interests include social inequality, education, crime, and public policy evaluation. His works have been published in the Annual Review of Sociology, Policy Sciences, European Sociological Review and Studies in Higher Education.

Paolo Brunori, is assistant professor in microeconomics and teaches at the Cesare Alfieri School of political science at University of Florence, he taught from 2011 to 2017 at the Department of Economics and Finance at the University of Bari. His research interests concern inequality and in particular methodological and statistical aspects of inequality measurement.

Wait or hurry? The effects of the early school enrolment on the school outcomes of Italian students Giovanni Abbiati

Introduction. In Italy the law allows families to enrol their children in primary schools one year in advance (the so-called "primina"). This possibility is allowed in two different ways. In the first case, early enrolment is allowed to children who turn six by the 30th of April of the reference school year. In the second case, it is possible to enrol the pupil directly in Grade two, given that he/she passes an entry test created ad-hoc by the school.

Early enrolment has always sparked a lively debate among psychologists, pedagogists and school staff. Those in favor emphasize the importance of a flexible school system, allowing the talented to anticipate school entry; the majority of them warns, though, that early entry should be allowed only after consulting the pediatrician. Those opposing the law signal the pivotal importance of free play and physical activity for proper cognitive, affective, physical and relational development of young kids. Furthermore, they add, the students who take advantage of the early enrolment would find themselves to be much younger than their classmates, with all that follows in terms of expectations from teachers and interactions with classmates. The literature currently present only qualitative evidence. To our knowledge, there is no systematic study on the phenomenon.

Research object. The following contribution aims at sheding light on the phenomenon of early schooling by describing its evolution over time and the profile of families who make use of it, highlighting the link between territorial factors, the strategies adopted by families and their impact on their children's learning. In doing so, we will estimate the effect of early enrolment on students both in the short term (on learning and attitudes) and in the long term, measuring the regularity of the school path from primary to upper secondary school.

Data. In this contribution I will make use of two databases. The first has been constructed by aggregating all INVALSI sample students from 2011-12 school year to 2018-19 taking the Grade 2 and Grade 5 tests. The database counts about 400,000 observations, similarly distributed between Grades 2 and 5. The second, which counts about 50,000 observations, examines instead the cohorts that took the INVALSI Grade 5 test in the school years 2012-13 and 2013-14. By now, these are the only two cohorts for which it is possible to longitudinally reconstruct the school career at Grades 8 and 10.

Method. The evolution of the phenomenon over time and the description of the family profiles will be investigated using multivariate statistical analysis. In particular, I will try to understand in what context and under which conditions families opt for early enrolment.

To investigate the effect of early enrolment on student achievement I will employ data on primary schools only, where the percentage of repeating students is null. Descriptive association between the outcome variables and early enrolment will be estimated using survey year and school (or class) fixed-effects models. The models will be then enriched by using individual level predictors available in INVALSI databases (gender, place of birth of the student and parents, level of education and profession of both parents, kindergarten and preschool attendance).

Impact estimates of early enrolment will be produced by comparing the outcome of the students who took advantage of the "primina" rule with the students of their birth cohorts born in May, that in vast majority took the test one year later.

Results. Preliminary results show that early enrolment is a phenomenon that characterizes the experience of Southern schools, while it is marginal in the rest of the country. This phenomenon is particularly pronounced among those born in January, (80% early enrollees in the South) especially if they come from high status families (97%). Estimates on the effect of early enrolment show that it negatively affects students' learning in both second and fifth grade by about 0.1 standard deviations; early enrolment, furthermore, is also more likely to be associated with grade repetitions and enrolment in non-academic secondary schools.

Giovanni Abbiati, currently holds a position as researcher in Sociology at the University of Milan, Department of Social and Political Sciences. His main research interests include social stratification theories and public policy evaluation.

TEMA 3. INVALSI DATA: A TOOL FOR IMPROVING TEACHING AND FOR EVALUATING

TRANSVERSAL SKILLS Organizer: INVALSI Coordinator: Stefania Mignani February 26th: 16.15 – 18.30 {Room Eva Mameli Calvino – Research 10}

An exploratory study on the connection between INVALSI assessment and Mathematics teaching and learning processes at the Primary School level Eleonora Faggiano - Annarita Monaco - Ottavio G. Rizzo - Valentina Vaccaro

This contribution shows the first results of an interdisciplinary research project aimed at investigating, through the voice of teachers, the link between the INVALSI assessment in Mathematics and the Mathematics teaching-learning processes at the Primary School. The research project is conducted by the "INVALSI Group - Didactics and Disciplinary Knowledge" of the S.I.R.D. (Italian Society for Educational Research) on general education and disciplinary education, made up of disciplinary experts and pedagogists.

Specifically, the project aims to: investigate the beliefs of teachers regarding the knowledge and skills detected by the INVALSI assessment; explore the proximity/distance between the functions and objects of the INVALSI assessment, on the one hand, and beliefs and statements about the teaching practices of teachers, on the other hand.

In line with the aims of the S.I.R.D., one of the broader objectives of the research is to identify the training needs of teachers at national level and to propose guidelines for the improvement of teaching practices, regarding the use of INVALSI assessment.

As part of the project, a questionnaire was prepared, developed through a first online administration (try out), the preliminary results of which were presented in the IV Seminar "I dati INVALSI: uno strumento per la ricerca" in a contribution entitled: "Links between the INVALSI Mathematics tests and teaching practices: an exploratory study" (Arzarello and Ferretti, in press).

The questionnaire, revised on the basis of the results of the try out, was then administered in the school year 2019-20 to a large non-representative national sample. The purpose of the empirical, descriptive and correlational survey was to analyze the knowledge, teaching experiences and beliefs available to primary school teachers to read and interpret INVALSI survey data, in particular in the mathematical field.

The questionnaire consists of three sections: - one concerning mematics education (how teachers interpret the INVALSI assessment and the results); - one relating to aspects of general education (which beliefs and attitudes have teachers and how they pour them into teaching practices); - one that collects personal and context information.

In the first section, seven INVALSI questions are presented in their original formulation. For each of them, questions are proposed aimed at detecting the pedagogical knowledge of the mathematical content - the so-called Shulman's PCK - by the teachers (misconceptions, recurring errors, level of difficulty). In addition, comparative questions are proposed on the proximity/remoteness of the seven questions from teaching practices and National Guidelines and on the effectiveness of the INVALSI questions in assessing certain skills.

The second section, on the other hand, proposes three sets of questions regarding: the opinions of teachers on the INVALSI assessment; the educational usefulness of the INVALSI assessment; the didactic practices connected to the INVALSI assessment.

This contribution presents some results of the national survey and discusses some critical elements that emerged in the responses of the sample of teachers, relating, in particular, to the first section of the questionnaire. Finally, some interpretative hypotheses are formulated for these answers, for which further qualitative investigations are being planned.

Eleonora Faggiano, is assistant professor in Mathematics education at the University of Bari Aldo Moro. Since 1999 she has been involved in the training of Mathematics teachers. Her research interests concern, in particular, the integration of digital and non-digital resources in the teaching practices and in the teacher professional development.

Annarita Monaco, is a PhD in Social psychology, Developmental and Educational Research and she is a primary school teacher. She is an author and a trainer in Mathematics education in the primary school. Her research interests concern problem solving and the primary school teachers' beliefs.

Ottavio G. Rizzo, is assistant professor in Mathematics at the University of Milan. His research interests include the training (pre-service and in-service) of Mathematics teachers, the use of digital resources in teaching.

Valentina Vaccaro, is a PhD student in Mathematics and is a research technical partner at INVALSI (since 2018). She performs research and training activities in the field of Math Education. Her research interests involve the use of new technologies and games in the teaching/learning of Mathematics.

Difficulty perception in answering argumentative INVALSI tests: a qualitative study Camilla Spagnolo - Marta Saccoletto

Difficulties in Mathematics are an extremely broad and fundamental topic of Mathematics Education research. This issue concerns many different aspects. We can consider, for example, when a student faces a Mathematics question. In that moment the student could run into multiple difficulties that may depend both on the student's own characteristics, such as his/her skills and knowledge, his/her beliefs and attitudes; or by question peculiarities, such as the text or the mathematical content involved. In turn, these latter question characteristics might influence the student's idea of the question, and they might help to set up his/her perceived difficulties. Consequently, difficulties and perceived difficulties are two different - but closely related - aspects. In particular, we reckon that perceived difficulties affect the students behavior in addressing the question.

This research topic has already been addressed in the literature. In recent years, several authors have investigated how the variation of some elements within the questions can impact the students behavior and their perception of difficulty (Vicente et al., 2007).

Among the factors that influence students' approach to answering a written test, the text phrasing is vital: one formulation is not necessarily better or worse than another, but changing the wording actually changes the problem (Bagni and D'Amore, 2005). As pointed out by D'Amore (2000) and Bolondi, Branchetti and Giberti (2018), text changes, even if minimal, can affect students' approach to the problem. The text factors include, for example, editing, punctuation, syntactic complexity, word density, information order, explicit declaration of intermediate objects necessary for the solution (Laborde, 1995). However, the student solution strategy can also be influenced by numerical factors, such as numerical magnitude (Thevenot and Oakhill, 2005). This result is confirmed and deeply analyzed by De Corte, Verschaffel and Van Coillie (1988), who studied how the kind of number - such as integer, decimal greater or smaller than 1 - can affect students' difficulties and students' perceived difficulties.

Starting from the previous studies results, we decided to investigate the perceived difficulties relating to the INVALSI argumentative questions. Particularly, we pay attention to argumentative questions relating to the Numbers area. By first agreeing with the teachers of the classes involved in the experimentation, we selected questions whose contents had already been dealt with. This decision made it possible to exclude that the perception of difficulty with regard to the items was influenced by the fact that the students did not know the topic.

According with the literature results, we hypothesized and analyzed that, among the perceived-difficultiesinfluencing-factors, there may be the "three components of the difficulty of the WP" (Daroczy et al., 2015): the linguistic complexity of the question text, the numerical complexity of the arithmetic problem and the relationship between the linguistic complexity and the problem numerical complexity. Moreover, we investigated other fundamental aspects, such as students' attitudes and beliefs in Mathematics. The study is in two phases: the first one qualitative (already done) and the second one quantitative (still ongoing). The aim of the qualitative phase was to identify some perceived difficulties from the student points of view. The impact of these difficulties will be investigated in the second phase.

The first phase involved two first sections and two second sections of the Balbo-Lanza Higher Institute of Casale Monferrato for a total of 79 students. Students completed an online questionnaire which was followed by in-depth interviews. The questionnaire included some INVALSI items and some other questions with the aim of investigating the different perceptions of students' difficulties. The construction of the questionnaire was guided by the quantitative data on a large scale. To select the INVALSI questions, we followed these criteria: Numbers area, Grade 08 and 10, argumentative process, percentage of correct answer less than 50%. In addition, the questions had the same mathematical content. The purpose of the additional (mostly open) questions was to inquire students' ideas and to link them - in a strictly qualitative way - with students' attitudes, beliefs or peculiar INVALSI item elements. Particularly, we investigated the relation between the perceived difficulty and the request to construct or recognize an argument.

We divided the indicators collected in the first phase into a few broad categories: dependence on school practice, dependence on the importance of the topic, dependence on content, and etc. These indicators will be fundamental in the large-scale analysis (phase 2) to understand the weight of each factor.

In fact, starting from the qualitative phase results, we will build an adaptive questionnaire. This second phase will take place during this school year. In particular, we want to investigate how and to what extent the difficulty perceived by students is connected to the difficulty that is attributed to the task by the teacher and any relationship with the ability INVALSI levels. Furthermore, we will inquire whether it is possible to arrange the question in order of difficulty, varying some question elements.

Camilla Spagnolo, research fellow in MAT04 at the Free University of Bolzano. Her main research interests concern argumentation processes in Mathematics, competence teaching and teacher training. She is an adjunct professor at the University of Urbino and tutor at the University of Bologna. He is involved in teacher training courses aimed at all school levels.

Marta Saccoletto, Bachelor in Mathematics, she was a research assistant in Mathematics Educations at the Free University of Bozen. Currently Mathematics teacher at the I.S. Balbo Lanza in Casale Monferrato and, from November, PhD student in Mathematics Education at the University of Torino. From 2017 she has been collaborating with INVALSI, as G10 author, and from 2016 with ForMATH Project.

Students' reasoning on the grammar questions in the INVALSI tests Zuzana Toth

The present study analyses the grammatical reasoning of a sample of students on language awareness questions. The reasonings were elicited by means of focus group interviews, concerning language awareness tasks administered within the INVALSI test in the third class of lower-secondary schools. The analysis aims to deepen our understanding of the characteristics that differentiate the reasonings leading to correct answers from those leading to incorrect answers. The results suggest that the main differences between the two types of reasonings concern the ability to: 1) select the linguistic features relevant to the analysis necessary for the task solution; 2) switch attention between different levels of linguistic analysis and 3) make reference to an abstract representation of linguistic data. The extent to which these differences are observable in students' reasonings depends on the difficulty of the questions at the national level. Easier questions activate intuitive reasonings, which allow for the identification of the correct answer even without abstract reasoning, or an accurate selection of criteria to focus on. More difficult question require a more complex reasoning, based on abstract linguistic representations and the ability to pay selective attention, without getting distracted by linguistic features not relevant to the task. The students' reasonings on simple tasks are fairly homogeneous, based on intuitive analyses of linguistic data, while their reasonings on more difficult tasks are more heterogeneous, and can be distinguished by means of the above-described criteria.

Zuzana Toth is research fellow at INVALSI. Her research focuses on the development of linguistic competence and language awareness in L1, L2 and L3(s).

USING RESULTS OF SECONDARY ANALYSIS OF LARGE-SCALE ASSESSMENTS IN EDUCATION TO

INFORM EDUCATIONAL POLICY

ORGANIZER: MARIA MAGDALENA ISAC COORDINATOR: MARIA MAGDALENA ISAC FEBRUARY 26TH: 16.15 - 18.30 {ROOM LORENZO MASCHERONI - WORKSHOP 2}

Session 1

In this part of the workshop, participants will be introduced to the process of preparing a policy brief. The presentation will illustrate with examples the main features of successful policy briefs and will address the main challenges that are often encountered in connecting empirical findings to relevant questions in education debates at national and international levels.

Session 2

In this part of the workshop, participants will be introduced to an example of a policy brief (prepared for the IEA Compass: Briefs in Education series) particularly relevant to the European context and educational policy: tolerance toward immigrants among youth in Europe and the role of schools in promoting such fundamental European value.

Session 3

In this part of the workshop, participants will be introduced to an example of a policy brief (prepared for the IEA Compass: Briefs in Education series) particularly relevant to the Latin American context and educational policy: support for dictatorship as a form of government and the role of context and socialization agents (e.g., families and formal education) in instilling democratic values in future citizens.

Session 4

In this part of the workshop, participants will be introduced to an example based on a series of policy documents (prepared for UNESCO's Global Alliance to Monitor Learning) that develop and implement a strategy to measure SDGs 7.4.4 and 7.4.5 using data from International Large-Scale Assessments.

Maria Magdalena Isac, is a researcher at KU Leuven, Belgium and INVALSI, Italy. Her research is focused in the area of comparative evaluation of educational systems, with emphasis on understanding how different educational approaches contribute to young people's citizenship learning and on the use of large-scale assessment data.

David Rutkowski, is an Associate Professor of Educational Policy and Educational Inquiry at Indiana University. His research is focused in the area of educational policy and educational measurement with specific emphasis on international large-scale assessment and program evaluation. He is currently the editor of the IEA Compass brief series.

Ernesto Treviño, is the director of the Center for Educational Transformation, principal researcher at the Center for Educational Justice, and associate professor of the Faculty of Education at the Pontificia Universidad Católica de Chile. He is interested in developing better understanding of educational inequalities in Latin America, and studies the interaction between educational policy and practice.

Ellen Claes, is associate professor at the KU Leuven, Belgium. Ellen takes a didactic perspective on political science exploring the effects secondary schools have in shaping democratic knowledge, skills, and attitudes of young people. Recent studies focus on the civic and intercultural competencies of (student) teachers.

Andrès Sandoval-Hernández, is a lecturer at the University of Bath. He has collaborated with various international organisations including the OECD, UNESCO and UNICEF. His research interests include comparative analyses of educational systems using large-scale assessment data, with a focus on educational inequalities and civic education.

THEME 3. INVALSI DATA: A TOOL FOR IMPROVING TEACHING AND FOR EVALUATING

TRANSVERSAL SKILLS

ORGANIZZATORE: INVALSI

COORDINATORE: ALESSIA MATTEI FEBRUARY 26TH: 16.15 – 18.30 {ROOM MARIO LODI – TEACHING 3}

Studying the relationship between the students' incorrect answers and their proficiency levels Francesca Ferrara - Stefania Pozio

Introduction. In this work, we offer further developments of an exploratory study in which we analysed the incorrect answers by Grade 8 students to an open question (closed constructed-response item) of the national computer-based assessment of Mathematics administered in 2018. There were high percentages of missing and incorrect answers to this question. We studied the relationship between the proficiency levels of the students who provided incorrect answers and the nature of these answers (given by the centralised correction), through the notion of route coming from Stacey and MacGregor (2000). This allowed us to investigate the mathematical proficiency of the students, also in relation to misconceptions pointed out in the research literature (the term "route" refers to the approach to solving the question). In addition, we came to value partially corrected reasoning on the task and to take into account the importance of introducing a partial credit in the correction, following what already happens for PISA assessment.

Object and research hypothesis. We will consider other open questions released for Grade 8, even regarding different content domains, with high percentages of incorrect answers. We will use our approach to analyse the incorrect answers of the students to these questions in order to study whether the relationship between their nature and the students' proficiency levels still sheds light on the presence of correct resolution steps, some of which eventually close to giving a correct answer. In particular, we expect that a certain percentage of high proficiency (levels 5 and 4) students' answers, beyond being incorrect, reveals partially corrected reasoning, therefore less far from a correct answer.

We will further centre on the extent to which the question intent can affect the correction or the possible introduction of a partial credit. One hypothesis we have is that studying the nature of incorrect answers in relation to students' proficiency levels can give additional information for the assessment model, especially from the perspective of a refinement of both question intent and level description, by better connecting them to the processes of mathematical literacy.

Data. The subjects of our study are the Grade 8 students partaking of the sample in the national computerbased assessment test of Mathematics in 2018 or 2019, who therefore gave answers to the test items. We particularly focus on the responses of those students who solved the questions incorrectly, and exactly on those responses out of which it emerges that the students faced the required task to a certain extent. We also take into consideration the students' proficiency levels and their distribution with respect to the identified routes.

Method. The study method can be seen as a mixed method, which is mainly concerned with a qualitative, exploratory analysis of the students' incorrect answers for the study of their mathematical proficiency, and additionally with the quantitative information about the percentage of error and its relationship with proficiency levels. Such a method is significant in regard to the fact that the test takers are a representative sample of the entire Italian population. From the qualitative point of view, we first identify common characteristics of the answers in relation to the solving steps required by a question, and then we divide the answers into groups (and sub-groups), each of which highlights a specific route to the task, by paying attention to their being generative of difference. The graphs of the distribution of the routes with respect to the proficiency levels and, vice versa, of the distribution of the levels within the routes permit further analysis.

Results. Our analysis aims at characterizing the relationship between possible different ways (based on errors) of answering to a question of the assessment test of Mathematics and a certain "distance" from answering correctly, which may be also captured by the graphs of the distributions mentioned above. This helps us to better understand the quality of a cognitive analysis of the incorrect answers and their nature,

starting from the strength of the assessment model. We finally expect to be able to enhance the usefulness of the model to introduce partial credits, in order to add value even to only partially corrected responses and to expand the investigation to other types of questions, not necessarily open.

Francesca Ferrara, is Associate Professor of Mathematics Education at Università di Torino. Her research is mainly focused on products and processes in Mathematics teaching and learning, and on the role of the body and the technology in Mathematics. She is author of various publications on international journals and volumes.

Stefania Pozio, holds a master degree in Geology and a PhD in Experimental Pedagogy; she is responsible for the INVALSI Mathematics tests. She is chief researcher at INVALSI. Her main research field is the study of the errors that students make when answering the mathematical questions in national and international surveys.

Symmetry in primary school Valentina Barucci - Antonella Marconi

This contribution, which makes use of some INVALSI tests, with the related statistics, is the result of a collaboration between a university teacher and a primary school teacher. The contribution focuses on an experiment from last school year which provides for a continuation in the current year.

The subject of the research is the mathematical concept of plane symmetry and the way in which 6-7 years old children can master it, then applying it in various contexts. The didactic experimentation that took place in the 2019-2020 school year, had as its protagonist a first primary class and was divided into various moments:

• the mirror game: the children divide into pairs and each pair is arranged symmetrically with respect to a line drawn on the floor. One of the two children makes movements and the other in front reproduces the movements of his partner as if it were his image in the mirror. The movements were then standardized on a grid drawn on the ground;

• creation of symmetrical flat figures with respect to an axis with the use of various materials: tempera for color spots, scissors for cutting, markers for two-handed drawings;

• in search of symmetries: in one's body, in the leaves, in the letters of the alphabet in block letters, in various objects and illustrations;

• search for symmetry in the architecture and frescoes of the monastery of Santa Maria di Grottaferrata, overlooking the school.

The research foresees a second phase in the school year 2020-2021 and plans to make use of some INVALSI tests to be proposed to the second class of the primary school protagonist of the experimentation in the previous year. The aim is to control learning in relation to national responses and the responses of another second primary class of the same institution that did not do the experimentation. The INVALSI chosen questions relate to the concept of symmetry and are all "Grade 2", precisely: the D13 of 2011, the D8 of 2012, the D3 of 2013, the D20 of 2015 and the D22 of 2019.

In this second phase it is planned to ask the children also about the reasons for their answers.

The expected results are a confirmation or denial of the utility for learning motor and observation activities in different contexts of the same mathematical concept.

Valentina Barucci, now retired, has been Full Professor of Algebra at "Sapienza, University of Rome". She has published more than 50 research papers in Commutative Algebra in international journals. She was referee for numerous foreign journals and from 1993 to 2010 she was the head of various research projects funded by Sapienza University. From 1974 to 2020 she held mathematical courses every year at various faculties. In the last four academic years she has also taught in "Corso di Laurea" of Primary Education at Sapienza and has written a book "Mathematics for primary school" published by Libreriauniversitaria.it of Padova.

The INVALSI tests of Mathematics: materials for the construction of entry tests Rossella Garuti – Nicoletta Nolli

The pandemic has changed the landscape within which the entire society is moving, bringing new demands, highlighting new needs, but also opening new and interesting perspectives. Faced with this challenge, INVALSI has decided to exploit the vast wealth of knowledge accumulated in more than ten years of standardized tests, carried out on a census basis in some Grades of elementary school (II and V year), middle school (III year) and secondary school (II and V year). In these years INVALSI has accumulated a lot of information, a lot of data that, properly organized, can help the school to face the difficulties resulting from a long suspension of lessons in presence.

For this reason INVALSI has launched a project, described in the editorial of October 20th, 2020, edited by Roberto Ricci, (https://www. INVALSIopen.it/prove-dati- INVALSI-prospettiva-formativa/) to help the school to deal with the difficulties arising from the suspension of lessons in presence and a not easy resumption. Among the training and information tools that INVALSI provides, one in particular seems to us rather useful to investigate the entry skills of students who lost many months of school in attendance in the 2019-20 school year due to the pandemic. These are tests that have been built on the basis of the repertoire of INVALSI tests of past years.

These new tests are therefore designed in an innovative perspective compared to the evaluation tools proposed by INVALSI until now and are not replaceable to them.

The entrance tests are designed for the school grades immediately following those for which the INVALSI tests are scheduled, which typically take place in spring.

Therefore, tests of Italian language (reading comprehension), Mathematics and English (reading and listening) have been prepared for:

- the third primary - Grade 3;

- the lower secondary first Grade - Grade 6;

- the first secondary Grade - Grade 9;

- the upper secondary third Grade - Grade 11;

- the last year of upper secondary school - Grade 13 only for English (reading and listening).

In this paper we would like to describe the choices made for the construction of the Mathematics test for Grade 9 (beginning of secondary school). The entry tests were built from the materials available for Grade 8 (third Grade of middle school). When students get into secondary school it is very important for the teacher to be aware of the students' skills and competences, in order to organize a learning-teaching path that takes into account the starting points of all students, all the more so in such a troubled start as the 2020-21 school year.

The construction of an entry test requires the identification of some key aspects that you want to investigate and the vast repertoire of standardized INVALSI tests provides a broad research base.

The questions we asked ourselves for the construction of these tests are shown here.

- What contents are preparatory to the educational activities to be carried out during the first year of secondary school?

- What contents, even if not immediately expendable in class, should Grade 9 students have in light of the National Guidelines of the first cycle of instruction?

- What psychometric characteristics should the items have that can be included in an entry test?

- What information can such a constructed test give back to the teachers?

The answers to these questions represent specific educational choices that, over time, could become a useful guide for Mathematics teachers to use the INVALSI tests as entry tests.

For Grade 9 the entry tests of Mathematics are structured as follows:

- a test with 10 items for each field of the Theoretical Framework of the INVALSI tests of Mathematics (Numbers, Space and Figures, Relationships and Functions and Data and Forecasts) with propaedeutic topics and closely related to the topics generally developed in the first year of secondary school; - a test with 10 items for each field of the Theoretical Framework of the INVALSI tests of Mathematics with topics not directly related to the topics that generally develop at the beginning of secondary school, but that are foreseen in the final goals of secondary school; - a test with 10 items for each area of the Theoretical

Framework of the INVALSI tests of Mathematics with mixed items of the two previous types, which could be used either by students as a preparation test or by teachers as a verification test.

In addition, for each of the chosen items there is a sort of "identity card" of the item that contains all the didactic characteristics of the item: content, correct answer, question intent, didactical indications. The "identity cards" of the items were finally collected in a map in order to have a global view of the topics present in the test.

Rossella Garuti, Phd in Educational, methodological and training sciences. Expert at INVALSI for Mathematics tests since 2008. Expert on the evaluation of educational projects concerning use of new technologies (CNR). Member of the MIUR Scientific Committee (for Mathematics) National Curricular Guidelines 2012 (MIUR).

Nicoletta Nolli, Teacher of Mathematics and Physics at the Liceo Scientifico Aselli in Cremona; since 2016-2017 commanded by INVALSI. She has been involved, for several years, in teacher training and production of materials for teaching and training also with technologies (P.N.I, PON Project m@t.abel, Labclass Project, Mathematical Machines Project).

THEME 2. LEARNING ANALYTICS FOR IMPROVING THE PERFORMANCE OF STUDENTS AND INSTITUTIONS: METHODS, EVIDENCE AND PERSPECTIVES

THEME 7. CBT TESTS AND LEARNING ANALYSIS

ORGANIZER: INVALSI COORDINATOR: SAEDA POZZI FEBRUARY 27TH: 08.30 – 10.30 {ROOM ALDO VISALBERGHI – TEACHING 4}

Non cognitive skills: a network experience Luigi Umberto Rossetti - Lucia Scotto di Clemente - Maria Di Benedetto

This paper aims to report the results obtained from the experimentation of a pilot project in the area of "non-cognitive skills" in the context of an upper secondary school in the province of Benevento, Avellino and Naples.

Field of application. The structuring of the intervention concerns three main areas: • Methodological; • Digital; • Environmental.

The first of these derives from the evident need to identify, standardize, measure and compare an educational process on non-cognitive skills in different contexts, with the assumption that pupils, regardless of their educational background, obtain the best results in CBT tests when they also strengthen themselves the non-cognitive elements. The second represents the necessary and indispensable support for carrying out the experimentation especially in this moment of emergency situation (Covid-19); the concept of a learning environment, the differences between physical and online environments and their integration identify the importance of investigating the most effective tools and strategies. The last area, on the other hand, represents the subject/environment relationship and how the latter can exert an important influence on individual results in relation to the new operational/social context in which the new generations live with the differences and the necessary integration between physical and online environment. The environment is not an irrelevant part from a psychological point of view but part of the context itself with a double experimental action to be carried out in the school context on the main parts of the system: 1. Context; 2. Students; 3. Teachers.

The learning environment reflects a real change of perspective in the psycho-pedagogical field, passing from the teaching paradigm to the learning one. Therefore it becomes important to reflect not only on what to teach to whom we have to teach, but also to pay particular attention to how the learning support context is structured. This means that it is necessary to analyze the conditions and factors involved in the process: teachers, pupils, cultural, technical and symbolic tools.

Experimentation and participants. The main objective of the experimentation is to understand how and with what weight the non-cognitive variables affect the CBT results of the pupils. The choice of educational institutions was made taking into account: 1. Activation of INVALSI exercises; 2. Type of school; 3. Different geographic area.

The experimental path, which has already started, will be implemented in the following steps in the 2020-2021 school year: • Analysis of the state of the art in reference to "non cognitive skills" approaches; • Choice and sharing of the characteristics of on-line platforms for the administration of digital evidence; • Identification of non-cognitive variables (tangible and intangible); • Organization of activities with the schools participating in the experimentation; • Sampling of classes: identification of that group of elementary units (pilot classes) to be subjected to training; • Organization and implementation of the training process; • Implementation of CBT test exercise activities involving the pilot classes and other classes: the activity must be carried out according to a time schedule which, if not coinciding with the implementation dates, must still fall within a well-defined time range; • Organization and analysis of results: collection of all data and organization of their presentation; • Generalization of the intervention: evaluation of the possibility of making the model generalizable and possibly exportable to other contexts.

The contact persons for the three identified educational institutions are: • Prof. Rossetti Luigi Umberto (digital animator Ipsar Le Streghe Benevento bnrh030005); • Prof.ssa Scotto Di Clemente Lucia (Italian

teacher and referent of the evaluation of the P.E. Imbriani high school in Avellino); • Prof. Di Benedetto Maria (LS Liceo Scientifico Tito Lucrezio Caro Napoli naps060006).

The classes involved are: • Third secondary classes, first, second and fifth upper secondary classes.

Innovative elements. The innovative element of the experimentation is inherent in the attempt to measure in the field what can generate, in terms of added value, specific training on non-cognitive variables. There are many soft skills of a strictly personal type and also external (environmental), therefore trying to quantify their weight in terms of greater success in CBT tests represents a strategically innovative approach.

Another innovative element is the development of networking between several educational institutions. Being able to compare data on different schools and above all belonging to different geographic contexts presupposes obtaining more generalizable results.

Results. In order to provide tools to encourage innovation in teaching, this experimentation represents a starting point to arrive at an assessment of the impact on the effectiveness of the training on "non-cognitive skills"; the expected results at the end of the trial are: • Data of the pilot classes (third lower secondary classes and second and fifth classes of upper secondary school) broken down by school; • Data of non-pilot classes (third lower secondary classes and second and fifth classes and second and fifth classes of upper secondary school) broken down by school; • Data of non-pilot classes (third lower secondary classes and second and fifth classes of upper secondary) broken down by school; • Aggregated data; • Comparison report between pilot and non-distinct classes of the same school; • Comparison report between pilot and non-distinct classes of the same school;

• Comparison report between pilot and non-distinct classes between schools; • Statistical report in qualitative terms of the identified non-cognitive skills; • Creation of shared digital material data.

Luigi Umberto Rossetti, teacher of Business Administration in high schools and assistant professor at the University of Sannio. He has achieved PhD in Management and Local Development at the University of Sannio. Business consultant, auditor, expert trainer, he is the author of some scientific papers. Digital animator at high school and member of the Usr Campania Territorial Training Team.

Lucia Scotto Di Clemente, teacher of Italian language in high schools, engaged in projects and actions of the INVALSI on the evaluation of schools, member of the NEV and trainer in the actions on the OCSE PISA and INVALSI tests. She participated in the National Plans for Linguistic and Literary Education in a plurilingual perspective with INDIRE and USR.

Maria Di Benedetto, teacher of Mathematics and Physics in high schools, engaged in projects and actions related to the PNSD and both methodological and digital didactic innovation. She is an INDIRE consultant for school improvement and deals with learning and system evaluation. She is an expert trainer in the issues of competence in national courses and projects aimed at school teachers of all levels.

Vocational Schools and Maths: a possible alliance. A case study: improving Maths results. From INVALSI data analysis to an improvement of Maths teaching Bruno Chiozzi - Daniela Sartor - Rita Tegon

This work draws on 2019 Veneto INVALSI Report which highlights that in Vocational Schools few students reach Level 5 both in Maths and in Italian language and there are still too many students that do not even reach Level 3. At the end of High School more than 50% of the students in Vocational schools do not reach level 3 in Italian language and Maths.

Since these results below Level 3 show that students have not reached the key competences to exercise active citizenship acting autonomously and consciously, schools should investigate about the most suitable teaching methods and learning strategies to decrease inequalities.

This work takes into consideration the trend of the results from INVALSI tests at the end of the first two years of a Vocational High School (Business and Social Health courses) in Belluno from school year 2015/2016 to 2018/2019.

The analysis takes into account the following aspects: the characteristics of the school population, the students' distribution according to their learning level, the differences among the classes and the school effect.

The aim of this study is to analyse which elements, processes, organizational models and teaching methods, also supported by technological innovation, helped to reach top results in Maths, in comparison with the territory benchmark and schools with the same ESCS (Economic, Social and Cultural Status).

A further analysis of 2020/2021 INVALSI tests will be very interesting to deeply understand the effects of Distance Teaching (DaD) which, during 2019/2020, had to remodulate didactic planning.

Bruno Chiozzi, is a Italian language and History teacher (A012); in 2018-2019 "seconded" teacher employed in Belluno Area Office in charge of province teacher training, CLIL, English at Primary School and PNSD (Italian national Plan for Digital Education); since 2019-2020 "seconded" teacher employed in Veneto Regional School Office in charge of regional PNFD (National Project for Teacher Training), CLIL and "Small Schools"; listed in the Professional Trainers Register (RFP) n. 1012 of Italian Trainers Association.

Daniela Sartor, is a Primary School teacher; in 2018-2019 "seconded" teacher employed in Belluno Area Office in charge of Young Apprenticeship programs and Work- related learning activities, Education and Career guidance, Prevention of School Drop-out; since 2019-2020 "seconded" teacher employed in Veneto Regional School Office in charge of SNV (National Evaluation System) and INVALSI; Consultant for INDIRE improvement; listed among Veneto Region experts to support and train schools towards the National Evaluation System.

Rita Tegon, is a teacher of Humanities, Latin and Greek; NEV (member of the external evaluation boads) with INVALSI; consultant for school improvement with INDIRE; expert in methods and improvement processes for USRV (Regional School Office Veneto); trainer in Italian National Plan for Digital Education (PNSD).

The effects of distance learning on the teaching and learning of Mathematics in the fourth classes of a primary school Maria Francesca Ambrogio

In this work we will show the results obtained from the administration of an entrance test built on INVALSI questions, aiming at investigating the impact caused by social isolation and distance learning (DaD) – imposed by Sars-Cov-2 health emergency – on Mathematics teaching-learning. The test was administered to Grade 4 primary school classes belonging to the same Institute. For this purpose, methodologies, tools and results of the different classes are analyzed both before and after DaD.

We collected students results in an entrance test built using Grade 2 and 5 INVALSI questions and compared it with results from the national 2018-2019 INVALSI Grade 2 test performed by the same students.

One of the four classes taking part in the study also participates in an action research project on the use of mathematical games in Mathematics teaching-learning. This project is running since 2017-2018 school year. Results collected from the first two primary school years were presented in the Fourth Seminar "INVALSI data: a tool for research" in a contribution entitled: "Mathematical games as a tool for learning diverse and lasting skills" (Ambrogio and Vaccaro, in course of publication).

During the DaD period, despite having an e-learning platform available, it was not possible to teach synchronously and consequently set the teaching in laboratory form.

This change of methodology has revealed problems in both the content of the discipline and in the metacognitive processes implemented by the students in the resolution of problems. It was therefore decided to administer a test built using both Grade 2 and Grade 5 INVALSI questions, in order to verify the knowledge, skills and competences of the pupils after the resumption of normal-in presence teaching activities. Results were compared to those obtained in 2019 and to results from three control classes belonging to the same Institute.

In this contribution the survey results are presented and some emerging critical elements in the students' responses are discussed. It is also intended to reflect on the maintenance, in exceptional circumstances, of the knowledge, skills and competences learned with the use of mathematical games, comparing the data with those of other classes in the same Institute. Finally, some interpretative hypotheses are formulated for these answers.

Maria Francesca Ambrogio, is a Primary School teacher at the I.C. of Santena (TO) and is the Instrumental Function for the Evaluation and Self-Assessment of the Institute, a member of the INVALSI Commission, general referent of the DDI, is part of the Innovation Team, responsible for the Laboratories, deals with training for teachers and is a promoter of STEM projects.

THEME 6. INVALSI DATA AS A TOOL TO SUPPORT INNOVATION AND SCHOOL IMPROVEMENT Organizer: INVALSI Coordinator: Cristina Stringher February 27th: 08.30 - 10.30 {Room Alberto Manzi - Teaching 5}

What improvement actions? Daniela Nuzzo

The paper starts from an experience (a school community reflects on the results of the INVALSI tests) and narrates the impact that the reading and interpretation of data, which took place in the school and entrusted to school staff, had on the improvement of the institution itself. In particular, targeted management choices, also motivated by the results of the tests, have reshaped the number of disciplinary hours for some subjects of a high school (Liceo classico), bending the training offer towards STEM disciplines.

The reflection that we intend to propose examines, in detail, strategic choices, improvement actions and results achieved over a five-year period at a classical high school in Lecce (Puglia), with various users, even complex contexts and number of students in constant growth; "curvatura" and "sperimentazione" implemented were also accompanied by systemic choices in favor of extra-curricular projects and extensions included in the PTOF and consistent with the actions envisaged for the improvement process.

The result is a "new" internal structure, peculiar in the panorama, which is examined, in the paper, from three different point of view: the use of INVALSI data as a motivation and argument in favor of strategic actions for PDM; reading INVALSI data as an external monitoring tool of the progress of the improvement processes; the interpretations of INVALSI data as guidelines for the reporting and social balance.

The paper will tell how, given some observations and an initial hypothesis, the same data have guided the institution to a broader analysis of the processes that see it involved, contributing to the definition of new innovative design scenarios, but, above all, in the reconstruction of the reflections matured and collected, will narrate how the statistical survey has become an opportunity for shared reflection on implemented processes, for metacognition around strategic choices and for the negotiation of reading and rereading the experience of the school community.

The subject of the research are the relationships that have existed/may exist within a school, between reading and interpreting INVALSI data and improvement actions (as conceived and planned in the Institute's PdM). In particular, the results of two distinct classes are reported, starting from the evidence collected, one with "traditional" training offer, the other with "curvatura". The data collection proceeds through several school years, gradually widening the field of investigation and incorporating new parameters and variables. The result is a variegated and composite fresco, above all of the process carried out by the single institution and its school staff in the effort to read, interpret and reuse INVALSI data; secondly, an interesting diachronic perspective in the census of the short-term outcomes of some strategic choices; finally, the evidence of a direct influence, sometimes in the reading of the data detected as a mere number, between the results of the INVALSI tests and the remodeling or redesign of the improvement actions.

The paper arises from the examination of data accumulated over a five-year period, from 2014-2015, in continuity, both inferred from the returns of the INVALSI Grade 10 and 13 tests, as accessible by the school, and from qualitative and quantitative data collected by the same school, various and heterogeneous, but always responding to immediate need internal monitoring of the improvement actions undertaken.

Using empirical methods, the school followed in parallel the results of two classes of the Institute, one involved in the experimentation, previously referred to as "curvatura", the other "traditional", giving reading and interpretation of the data collected.

From a purely oriented perspective to the legitimation of the actions undertaken, we have moved on from a broader analysis, surveying and comparing even dissimilar contexts, different subjects, gender of the pupils and introducing different variables, paving the way for an investigation into the multi-criteria intentions, certainly broad spectrum.
The reflections thus led to results that enrich the initial hypothesis: correlations not initially hypothesized, emergence of new requests for improvement, budgets of the actions taken. The results were grouped into three different macro-areas: - the use of INVALSI data as a generator of strategic actions for PDM; - reading INVALSI data as an external monitoring tool of the progress of the improvement processes put in place; - the interpretations of INVALSI data as guidelines for the reporting and social balance of the experiences gained.

The contribution thus acquires the physiognomy of reflection on a definition of "quality" of the education system and reports, as a whole, the proposal of a possible way of reporting the school effect.

Daniela Nuzzo, teacher of literary subjects in high schools, PhD in "Historical and Philological Sciences", paleographer, archivist, trainer, cultivates interests and curiosities in different fields: evaluation, teaching, ICT. Involved in implementation projects of the national evaluation system, passionate about fine literature and literature, she follows and coordinates projects dedicated to the promotion of reading and writing.

Improve to evaluate Network project - Ministerial Decree 851/2017- Article 33 "Evaluation of Students in 1st Cycle Schools" Ornella Campo - Giorgio Cavadi - Marinella Pitino

Search for innovative hypotheses responding to the need to build an evaluation system capable of combining the specific requests and the results of the triple dimension of internal evaluation (understood as the outcome of school results), in correlation with the certification of skills and with the results of national surveys, is what we tried to achieve with the network project "Improve to evaluate" with which the Istituto Comprensivo "E. Berlinguer "in Ragusa was selected as a regional school for the implementation of the actions provided for by art. 33 of Ministerial Decree 851/2017.

The project focused attention on improving the skills of teachers in the evaluation field: improving in order to move towards a "good" evaluation, descriptive, progressive because formative, in line with the legislative framework outlined by Legislative Decree 62/2017.

The design process, based on a network of purpose to which 22 schools of the first cycle of Sicily have joined, activated a cascade training system that involved trainers, teachers and managers, proposing research / action paths within the participating schools.

The expected result was the modification of the evaluation paradigm which, overcoming the sanctioning value, points to a prospect of improvement capable of triggering a significant change in teaching practice.

Specifically, the work path carried out was focused on the search for a possible correlation between the three different types of evaluation in use: • the evaluation of learning released by the evaluation form with the mark expressed in tenths; • the certification of skills referred to in DM 741 and 742 of 2018 described with levels of competence; • the attestation of the results at the INVALSI tests at the end of the first cycle of education issued by the INVALSI with the use of synthetic and analytical descriptors.

The experience, which involved more than 900 teachers on a teaching methodological level, summarizes a plurality of training actions characterized by a constant interweaving of the most advanced pedagogicaldidactic theories, the correlation between numerical evaluation and progressive level descriptors, the methodology action research in the didactic field and reflection on empirical studies - and tackles in an operational way the theme of the definition of the curriculum and of the evaluation criteria used in first cycle schools, proposing an experimental model that approaches the method of evaluating school learning to the evaluation criteria of the certification of competences and standardized INVALSI tests, in a perspective that shifts the focus from the grade to the descriptor.

The work path has tried to recover a significant relationship between design models, teaching methodologies and evaluation tools by identifying, in the progression of learning towards the expected goals, a unique criterion of reference for the evaluation, able to combine the personal paths of the students with the verification of the achievement - during the eight years of schooling of the first cycle - of fundamental learning standards.

The research process initiated by the project involved the following methodological-didactic aspects: • the pedagogical-didactic system of the PTOF of the schools involved in the network; • the construction of the vertical curriculum for disciplinary skills according to the National Indications for the Curriculum of 2012; • the description of the progressive levels of disciplinary mastery; • the new criteria for the evaluation of learning in the first cycle.

The priority objectives, identified and shared by the schools belonging to the network, specifically envisaged interventions aimed: • to carry out support actions for first cycle schools for the implementation of new regulatory interventions on the evaluation of student and student learning, introducing research/action paths aimed at experimenting with innovative evaluation practices; • to deepen the issue of certification of skills by identifying adequate evaluation tools; • to introduce authentic assessment into teaching practice; • to facilitate and support accompanying initiatives for the carrying out of national standardized tests through the study of the relevant reference frameworks developed by INVALSI; • to promote the culture of evaluation aimed at improving training processes; • to build virtual platforms for sharing methodologies, operational tools and good evaluation practices; • to carry out continuous monitoring and dissemination of materials produced as part of the interventions implemented.

The methodological approach used took into account the various actors involved, enhancing their experience and know-how in a systemic perspective, in compliance with the reference regulatory framework and the PTOFs implemented in schools. The design model was inspired by the principle of transferability and replicability of training experiences and aimed at the introduction of the research/action methodology in the classrooms of online schools, favoring the production of experimental and innovative materials in the evaluation field.

The elements that characterized the entire process, certifying its validity, concerned: • to exchange and comparison between schools on the net; • the use of research/action as a common working method; • the authentic evaluation; • documentation of processes and products; • periodic monitoring.

A further element of innovation supporting the entire path lies in the technological support provided by the Platform which has made it possible to provide training and information activities also in blended mode, complementing face-to-face training with distance training.

Ornella Campo, is a school manager expert in self-assessment and external evaluation processes and collaborated with INVALSI as external evaluator in VALES and Evaluation and Improvement project. Trainer expert in system evaluation and component of regional support groups on national guidelines and in the introduction of innovative processes in the school environment.

Giorgio Cavadi, is Inspector at the Ministry of Public Education, trainer and expert in the assessment of learning processes, evaluation and self-evaluation, as well as measures to improve the performance of educational institutions. He currently writes essays and articles on journals specialised in education and school issues.

Marinella Pitino, is a primary school teacher, coordinator tutor at the University of Enna, expert in selfassessment processes, NEV expert from INVALSI and member of the institute's NIV. PNFD expert trainer in the areas of "Teaching by skills" and "Inclusion and disability", expert for the Plan for language training for primary school teachers, laboratory teacher and TFA support tutor.

A quantitative study on distance teacher training using INVALSI data Camilla Spagnolo - Giorgio Bolondi - Rita Giglio - Sabrina Tiralongo

The pandemic crisis that overwhelmed us last year is still reflected in teachers' teaching. This article wants to highlight some of the positive aspects that distance learning has brought to Mathematics education through the use of INVALSI data.

Digital learning has reshaped education in many ways (Mulenga and Marbán, 2020) and the consequences have affected students and teachers worldwide (Sintema, 2020; Mulenga et al., 2020; Borba et al., 2020).

The global "blockage" of educational institutions has caused interruptions in students' learning, interruptions in internal assessments and the cancellation of some of the assessments or their replacement

with a secondary alternative. It has been of interest to many researchers to understand how to accompany educational needs taking into account the specific contexts of each one (Reimers et al., 2020).

During the period of distance learning the ForMATH Project association has carried out free distance learning courses aimed at teachers of all school levels. These courses have been structured in 16 webinars involving 2,539 Italian teachers.

Six webinars have been structured using INVALSI questions to create distance learning situations to be proposed to students.

With the beginning of the school year 2020-2021, in collaboration with the Free University of Bozen/Bolzano, a follow-up questionnaire was developed. One of the aims of this questionnaire was to clarify how this experience could be linked to the teacher training processes in the post-Covid era. The questionnaire investigated in particular whether and how the INVALSI questions presented during the webinars were known by teachers, whether their results were known, whether this contact with the INVALSI questions had an impact on their practices and beliefs.

The questionnaire was administered to all teachers who participated in the webinars and so far almost 300 responses have been recorded.

The study is currently underway and the first feedback has clarified the reasons why the teaching activities proposed during the courses and the ideas related to the INVALSI questions and their results have been (or have not been) used by the teachers. We want to document this experience of inserting the INVALSI tests in a distance learning path and highlight how these paths have been inserted in a classroom context.

Camilla Spagnolo, is research fellow in MAT04 at the Free University of Bolzano. Her main research interests concern argumentation processes in Mathematics, competence teaching and teacher training. She is an adjunct professor at the University of Urbino and tutor at the University of Bologna. She is involved in teacher training courses aimed at all school levels.

Giorgio Bolondi, is a Mathematician, Phd in Algebraic Geometry, is interested in how mathematical knowledge goes from generation to generation and from person to person. He teaches at the Free University of Bozen/Bolzano; his current research activity is focused on the assessment of learning and the professional development of Mathematics teachers.

Rita Giglio, is graduated in Mathematics at Bologna University. She is currently a secondary school teacher. She collaborates with ForMATH Project and Eduval.

Sabrina Tiralongo, is graduated in Mathematics with a thesis in Math education. She deals with the dissemination of Mathematics, activities with students and teacher training. She collaborates with INVALSI for the construction of the Mathematics tests for the lower secondary school. She is currently a secondary school teacher. She collaborates with ForMATH Project and Eduval.

THEME 3. INVALSI DATA: A TOOL FOR IMPROVING TEACHING AND FOR EVALUATING

TRANSVERSAL SKILLS Organizer: INVALSI Coordinator: Stefania Pozio February 27th: 08.30 - 10.30 {Room Rosa e Carolina Agazzi - Teaching 6}

"Making room" for numbers on the number line Francesca Ferrara - Giulia Ferrari - Ketty Savioli

Introduction. Mathematics education research highlighted the need for working both with diverse registers of representation and with different treatments of a register to favour learning processes (e.g., Radford, 2002; Duval, 2006; Arzarello, 2006). The role of visual representations, together with connected difficulties and limits in Mathematics learning, was also studied by Arcavi (Arcavi, 2003), who pointed out how "visualizing" (or visualization) in Mathematics involves processes of creation, interpretation and reflection on figures and images. In this contribution, we focus attention on some questions of the two last Mathematics assessment tests, which implied the use of the number line for representing and ordering numbers at different Grades (2, 5 and 8), therefore requiring mathematical proficiency to master the numerical and 'graphical' registers, as well as their interplay. The questions are all concerned with the content domain of Numbers and the cognitive process of Knowing. Nevertheless, from the cognitive point of view, they do not only implicate knowledge of the considered numbers (rational or not; content) for the students at all levels, but also the capacity to read and interpret the information given by the representation (process).

Object and research hypothesis. Our research regards the processes at play in solving tasks about "operating with, ordering and comparing numbers", which is the matter of the Grade 8 questions we are interested in. The questions considered for Grades 2 and 5 can also be referred to the same matter. All the questions ask to determine or position one or more numbers on a given number line, graduated with a scale to be inferred from the representation. Our hypothesis is that many of the incorrect answers provided to these questions may be related to difficulties in mastering and treating the representation of numbers on the line, which requires itself attention to measure aspects conveyed by the scale directly introduced by the visual elements of the representation (e.g., the distance between consecutive marks, the already positioned numbers, and so on).

Data. We first consider some questions of the National assessment of Mathematics, from primary to lower secondary school, which concern operations, ordering and comparisons between numbers, based on the representation on the line. All the questions refer to the goal of the National Guidelines for which the student is able to use calculations also with rational numbers, to master the different representations and to estimate the magnitude of a number and the result of operations. We centre on Grade 8 questions of the 2018-19 CBT, and on paper-based questions administered at Grades 2 or 5 in 2017-18 and 2018-2019. While the Grade 8 questions have a medium-high level (3 and 4) of difficulty, there are primary grade questions that behave in particularly interesting manner, like one Grade 5 multiple choice item that got only the 17% of correct answers and a very low 1.4% of missing answers, together with almost uniform percentages for the choices.

To better understand the way students work with the number line, we additionally examine: the answers to some questions, which were delivered in the last two years during a local project to various Grade 3, 4 and 5 classes of primary schools in the area of Torino, designed with a similar approach; the answers to one Grade 2 question from Grade 2 learners and their arguments.

Method. We use data about the assessment items as for the way they are framed by the National Institute for the Evaluation of the Education System to investigate the cognitive aspects they are concerned with. For looking at the students' processes, we then take advantage of a qualitative analysis method that considers the characteristics of the responses to similar questions, provided both in Grades 3 and 5, and in Grade 2, along with the children's corresponding arguments. Finally, we relate these characteristics to the nature of

the mathematical representations and tasks used in the questions, particularly regarding the treatment of the representations.

Results. Examples of the students' errors or responses will be shown to discuss difficulties than can be associated to the spatial treatment of the representation of numbers on the number line, which is crucial to solve the questions. This discourse is particularly relevant since the representation of numbers on the line is used since the early grades to be exploit throughout the entire school career (the same is pointed out by the assessment items). It therefore deserves special attention as a didactic routine. From the educational point of view, we will stress the need for working deeply and at different degrees on the processes of interpretation, treatment and control of the representations, especially that of numbers on the line.

Francesca Ferrara, is Associate Professor of Mathematics Education at Università di Torino. Her research is mainly focused on products and processes in Mathematics teaching and learning, and on the role of the body and the technology in Mathematics. She is author of various publications on international journals and volumes.

Giulia Ferrari, earned a Phd in Mathematics with a dissertation on Mathematics education research and is now research fellow at Università di Torino. Her research focuses on the role of movement and technology in mathematical activity. She is part of research and teacher training projects and public engagement initiatives, and author of papers in the field.

Ketty Savioli, is a primary school teacher at Istituto Comprensivo Chieri III (TO), with a master degree in Mathematics from Università di Torino. She leads projects on the evaluation and improvement of the school system. She collaborates with the National Institute for the Evaluation of the Education System and took part in Grade 4 TIMSS design.

Adam and Eve in Mathematics: myths, stereotypes and beliefs. But is it all true? Ivan Graziani - Stefano Babini - Chiara Saletti

There are several myths about male and female performance in Mathematics that have already been debunked by various researches. Even the stereotypes carried out by advertisements, some box games and textbooks tend to distinguish the female world from the male world from an early age.

Some beliefs are still handed down that males would be better suited to Mathematics and Science in general, and various campaigns have worked to debunk this, while females would be better at literary and humanistic subjects.

With our research we don't want to enter into these disquisitions, which have already been dealt with extensively, but we wanted to find particular questions, some with roles established on the basis of stereotypes and others in which these figures were not well outlined, but where common experience would seem to favour one sex over the other.

To do this, we conducted a vertical research, between the first and the second cycle, to see how answers to questions, even apparently easy ones, could hide dangers that could facilitate females or males.

We then selected eight questions, through the Gestinv website (www.gestinv.it), and assembled a google form which was then administered online through a link, and above all thanks to the collaboration of teachers from various parts of Italy, to students in the fifth grade primary school classes, the third grade secondary school classes and the third grade secondary school classes, with different high school, technical and professional addresses.

Due to the typical structure of Googles Modules, in our work we have mainly considered single or multiplechoice questions and, according to what is contained in the National Indications for the first cycle and in the INVALSI Reference Framework, mainly the questions concerning the dimensions of "Knowing" and "Solving problems".

The purpose of our research is to check whether there are some types of items, which may in some way favour males or females and also whether there are more typical errors for one sex than the other in the different school orders observed.

Ivan Graziani, teaches Mathematics and Science. Trainer in Mathematics didactics. Passionate about ICT, problem solving and didactic communication. He is part of the "Research and Experimentation Group in Didactics of Mathematics - Pisa" (GRSDM) and the "Divertical-Math" research group. He has been collaborating for years with UNIBO, INDIRE, INVALSI and Mondadori-Rizzoli educational.

Stefano Babini, teaches Mathematics and Physics. Passionate about problem solving, didactic communication and new technologies applied to teaching. He deals with learning and evaluation processes in various training and system contexts. He is part of the research group in Mathematics didactics "Divertical-Math". He has been collaborating with INVALSI for years.

Chiara Saletti, who graduated in Literary subjects in 1995, is a primary school teacher at the Istituto comprensivo "Masaccio" in Florence and author of school texts. Included in the ordinary INVALSI list of SNV and Valu.E. experts, she deals with evaluation at provincial and regional level, with training acquired at INVALSI and the Politecnico di Milano.

Me and Mathematics: validation of a questionnaire to evaluate metacognitive factors related to Mathematics at the beginning of secondary school Chiara Giberti - Marianna Nicoletti - Giorgio Bolondi

Research in education has increasingly highlighted the importance of metacognitive factors within the learning processes of Mathematics: beliefs, emotions and motivations play a fundamental role in activating, controlling and finalising the work done by the student. These factors often interfere heavily during the transition from one school to the next one, creating crises and fractures that are then difficult to remedy.

Many teachers give their new students Mathematics entry tests; the aim of these individual diagnostic assessments is to provide information on both specific Math competences and cognitive processes adopted by the students.

In this paper, we are going to present the results of a survey carried out to find out about middle school students' feelings about and approaches to the subject of Mathematics.

Five hundred students from schools all over Italy took part in the survey, which was used for an empirical study last year. This has allowed us to improve the accuracy of our survey and create a benchmark for using the survey on a large scale.

This survey is designed to bring out indicators of these aspects from the child's choices and words.

It is composed of a first part, that looks very friendly for the recognition of student's emotions relative to Mathematics. The second part uses a questionnaire, modelled on the questionnaire employed in the OECD-PISA survey to detect motivation and self-efficacy, but for which questions taken from the INVALSI tests were used. Finally, the third part foresees to rewrite in first person, in the form of a diary, a situation taken from an INVALSI question. By means of specific indicators, the elements collected are inserted in a survey form and then organized following different directions. This allows to trace a first metacognitive profile, relative to Mathematics, of each pupil.

The inclusion of INVALSI questions enables, on the one hand, the use of situations that are deeply known, thanks to the data collected by the Institute and to the researches that have been developed on them. Indeed, using INVALSI questions, we have also information about their functioning from a content point of view and the difficulties in relation to the children's abilities: therefore, we have a very accurate control of the cognitive aspects related to the task. On the other hand, it also allows the identification of any specific behaviour related to the tests themselves, which are often charged by teachers with emotional aspects.

In this paper we present the process of validation of the questionnaire and the reference benchmark that is fundamental for using the questionnaire on a large scale, in order to provide teachers with immediate feedback. In fact, teachers using the questionnaire in their classes will immediately have available a feedback on the absolute results of their class and the same results compared with the reference benchmark consisting of classes from all over Italy characterized by very different realities, so it will be possible a more in-depth reflection based on this comparison.

Chiara Giberti, Phd in Math education and researcher at the University of Bergamo. She collaborates with INVALSI and her research interest focuses on the potential of standardized assessment in Mathematics education research. She is also a Mathematics and science teacher in middle school and she collaborates with the center for innovation in the educational field Future Education Modena.

Marianna Nicoletti, master degree in Mathematics, she teaches Mathematics and science in middle school. She collaborates with INVALSI in the construction of mathematical assessment tests. She is the author of books for the learning of Mathematics and in particular for students with special needs.

Giorgio Bolondi, Phd in Algebraic geometry, full professor of Mathematics at the Free University of Bozen-Bolzano. The focuses of his research activity are Learning Achievement Assessment and Teachers' Professional Development. He is the author of several papers and books on the divulgation and teaching of Mathematics.

Developing basic mathematical skills and transversal skills starting from INVALSI questions Chiara Giberti - Marta Saccoletto - Michela Testa

In the academic year 2019-2020, due to the Covid-19 health emergency, the Italian universities courses were online. At the beginning of the following academic year, the University of Bergamo, located in an area that was particularly affected by the pandemic, offered specific courses aimed at the consolidation of some basic skills. The course focused on mathematical skills has included six online meetings in sync. The number of students involved (about 10) has been contained, the purpose of this choice was to encourage participation and dialogue between the participants. Students who currently attend different years of the degree course were involved.

The aim of the Math course was recovering some specific basic skills in Mathematics but, at the same time, it also allowed to work on transversal skills (argumentative skills), metacognitive skills (reflecting on solution processes and transposition - when possible - the same contents for primary school students) and affective skills (relationship with Mathematics and INVALSI tests).

During the first online meeting the students answered a cognitive questionnaire. This tool gave us the opportunity to gather contextual information and information about the relationship between the participants and Mathematics. From the answers of this questionnaire, some important information has emerged, in particular on the vision of Mathematics that the students had developed during their previous studies or during their teaching and internship experiences. Moreover, they were asked to reflect on the didactic activities or choices that they would like to follow or implement when they will be teaching Mathematics in primary school. Finally, the students answered to some questions related to argumentative skills.

Subsequent online meetings focused on the use of specific INVALSI questions. These items allowed us to work on three content areas and to reflect both on the mathematical content itself and on its transposition in the primary school context. For every different question the schema of the meeting was the following. Firstly, the students were divided into groups, which worked in a different Meet room. Hence the participants had the opportunity to solve every proposed question together and to reflect on strategies. At the end of the first part, the groups were asked to share their ideas with other groups using a virtual board (Padlet). In other words, each group was required to upload its own solution to the board, to describe and to argue it and, at the same time, to point out the mathematical contents involved in the question.

Secondly, all of the groups were asked to read and to comment - following some guiding questions - the answers and arguments of the other groups. From this Math discussion, not only within the group but also between groups, the students have been able to deal with different solution strategies and with different perspectives. In addition they could deeply reflect on the item difficulties, which may be related to a specific error. The discussion was always faced in sync. In this way we had the opportunity to outline the outcomes and to compare "our" results with the national INVALSI sample results. From the comparison of the INVALSI results, it was also possible to reflect on whether and how the same Math topic could be addressed in primary school and to hypothesize the solution strategies that a child of this age could propose.

Thirdly, each meeting included a brief study of the mathematical contents involved. We particularly paid attention to show some of the major difficulties connected with each Math topic.

Although we can only report qualitative information - due to the small number of participants - the course showed an improvement particularly in the argumentative skills of the students involved. This improvement is easily shown from the evolution - from the first to the last lesson - of the group's answers shared in the Padlets. Simultaneously, the discussion time within the groups considerably increased during the meetings. In fact, whether in the first session the discussion within the groups was little developed, at the end the students were more interested in a profound debate and, consequently, the discussion time enhanced.

Furthermore, it is interesting to note that whether in the first Padelet the student answers lacked formulas and the operations were verbalised, in the last meeting the formulas were used and the textual part was mostly dedicated to motivate or to explain their choices.

Several reasons lead us to choose the INVALSI questions for this course. Fundamental was the opportunity of having the national results, which facilitated the teachers in choosing the questions and allowed the comparison of the answers given during the course and those provided at a national level. This comparison process also allowed us to reflect on the different solutions from a didactic point of view. In addition, the participants witnessed the possibility, starting from a single INVALSI question, to set up an activity that included different skills. We therefore hope that this experience stimulated them to propose similar activities in their classroom in the future. Lastly, INVALSI tests are often experienced with fear not only by students but also by the teachers themselves, the course also had the aim of showing future teachers the potential of such tests not only as a summative evaluation but as a possibility to propose highly significant activities in the classrooms.

Chiara Giberti, Phd in Math education and researcher at the University of Bergamo. She collaborates with INVALSI and her research interest focuses on the potential of standardized assessment in Mathematics education research. She's also a Mathematics and science teacher in middle school and she collaborates with the center for innovation in the educational field Future Education Modena.

Marta Saccoletto, with a Bachelor in Mathematics, she was a research assistant in Mathematics Educations at the Free University of Bozen. Currently Mathematics teacher at the I.S. Balbo Lanza in Casale Monferrato; she is about to start a PhD in Mathematics Education at the University of Torino. From 2017 she has been collaborating with INVALSI, as G10 author, and from 2016 with ForMATH Project.

Michela Testa, with a Bachelor in Mathematics, she was a Maths teacher in high school "Liceo Amaldi" of Alzano Lombardo. From 2016 she has been collaborating with Matnet CQIA at the University of Bergamo. Her interest focuses on Mathematics laboratory for primary school and she collaborates with Associazione Diamo i Numeri.

AGENDA 2030: SURVEY ON SUSTAINABLE DEVELOPMENT GOALS THROUGH INVALSI DATA Organizer: INVALSI Coordinator: Barbara Baldazzi February 27th: 08.30 - 10.30 {Room Corrado Gini - Workshop 3, part 1}

Territorial inequalities in education: some aspects related to the territory Emiliano Campodifiori - Patrizia Falzetti - Michele Marsili

This work aims to describe the existence of inequalities in our country's educational field, which translate, in practice, into an unequally distributed possibility of achieving an adequate level of learning. Alongside the description of the phenomenon by means of cartograms that illustrate the regional percentage distribution of students in difficulty in upper V and in implicit dispersion, a research is conducted on the potential determinants of these territorial inequalities; for this purpose, multiple and logistic regression models are used to evaluate the significance and the more or less strong impact on the formation of the educational level of a series of variables not only strictly related to the student (socio-economic cultural background, origin of the student, etc.) but also to the municipal area of the high school attended (unemployment rate, size of the Municipality, etc.). The work ends with a cluster analysis in order to group the italian municipalities by similar territorial characteristics and to highlight any associations with the percentage of students in difficulty.

In the analyzes presented, we went beyond the regional average, using, in fact, variables at the municipal level in order to intercept sub-regional territorial determinants that have proved to be significant in the formation of the student's learning level; regression models suggest that municipal territorial characteristics such as the youth unemployment rate and the demographic dimension of the municipality have a significant impact on the level of learning achieved and/or on the probability of reaching the end of the second cycle of education without repetition; the cluster analysis finally made it possible to identify territorial realities in contrast with the regional averages, "excellent" contexts within regions or macro-areas characterized by a low level of learning.

Emiliano Campodifiori, graduated in Statistics and Economics at the University of Rome "La Sapienza". Since 2010 he works for the Statistical Service of INVALSI, he performs statistical analysis of the National Assessment data.

Patrizia Falzetti, is head of INVALSI Statistical Service, which manages the acquisition, analysis and return of data regarding National and International surveys on learning to schools, stakeholders and the scientific community.

Michele Marsili, graduated in Statistics at Sapienza University of Rome. He worked in Business Intelligence consulting, providing software development solutions for analysis and support for company's decision making in insurance and pharmaceutical industries. Since January 2018 he has been working in the Statistical Service of INVALSI.

Doing school but not at school: territorial peculiarities and socio-economic inequalities in access to distance learning Cecilia Bagnarol - Silvia Donno - Veronica Riccardi

Introduction. Covid-19 pandemic has strongly highlighted how social and economic differences among and within countries can contribute to increase the inequalities in health care and in many others aspects of people's lives, including education. The risk is that, instead of reducing the disparities based, among other things, on income and economic status (Objective 10 of Agenda 2030), we are moving towards a gradual intensification, also with regard to the right to education.

Research object and hypothesis. This study aims to investigate, within the national territory, how the transfer of all educational activities in the digital classroom affected home as the only physical learning environment. In fact, domestic environment, characterized by possession of adequate technological spaces and tools, can be discriminatory for certain sections of the population.

Hypothesis to be verify is linked to the weight of some family variables regarding the home environment experienced by students, both in terms of the availability of spaces to study and possession of digital devices (mainly computers and Internet connections), essential tools for distance learning.

In particular, the territorial dimension is taken into consideration in order to verify if the known territorial dualism (Centre-North vs South) that characterizes our country, is present in our data.

Population. This study is based on census data from the INVALSI 5th Grade Student Questionnaire for the academic year 2018-2019. In particular, two types of variables are used: some that investigate the availability of adequate spaces and the possession of tools within the home, others that refer to socioeconomic and cultural characteristics of the families (like educational qualifications and profession of parents).

Methods. After descriptive analysis, useful for adequately framing the variables investigated, the georeferencing procedure of schools is carried out and, through the global (Moran) and local (LISA) Spatial Autocorrelation analysis, both univariate and bivariate, it is possible to identify spatial clusters of schools and bring out the territorial peculiarities.

Results. The analyses carried out show that Italy is divided into two (Centre-North vs South), but not always in a clear and defined way. Further evidence is linked to the demographic dimension of the different areas, which puts metropolitan areas in an advantageous situation. Parents' profession and educational qualification are confirmed as two fundamental, but not infallible, indicators in the material well-being of students.

Cecilia Bagnarol, graduated in Statistics, Economics and Business to Alma Mater Studiorum University in Bologna. She is part of the Statistical office of INVALSI, working primarly on statistical analysis on large database from National and International surveys.

Silvia Donno, graduated in Demographic Sciences for Social and Health Policies at the University of Rome "La Sapienza". Currently she works for the Statistical Service of INVALSI, she carries out activities to support the elaboration and statistical analysis of the data of the national surveys on learning.

Veronica Riccardi, PhD in Pedagogy, currently works at INVALSI. Her research interests mainly concern the field of studies of intercultural pedagogy, adult education and social pedagogy.

Gender gap: a trend analysis from low to high secondary school Andrea Bendinelli - Michele Cardone - Patrizia Falzetti

Based on the 17 Sustainable Development Goals (SDGs), this work focuses on Goal 5: "Achieving gender equality, for the empowerment of all women and girls", deepening the gender differences in the high school segment. Using INVALSI data, the students in the 8th Grade of 2014 were matched with those the 13th Grade of 2019, considering three dichotomous as output variables: the achievement of the last school year without repeating, the achievement of a level of competence attributed by INVALSI above/below "out of 5" which represents the threshold of sufficiency, or above/below "4 out of 5" which represents the threshold of the top performers).

Using these three dichotomous variables, three logistic regression models were constructed respectively, using as predictors some students' characteristics: socio-demographic (gender, origin, geographical area and family background), school performance (repetition at the low secondary school and score at the INVALSI 8th Grade tests of Italian language and Mathematics) and the educational qualification wished.

The models built on the levels of competence show a better representativeness than the first one based on the achievement of Grade 13, which we intend to re-evaluate in the future.

The results in part confirm what has already emerged in literature, in part they provide some new food for thought. From literature we know that females obtain better results in literary subjects and males in

Mathematics and the gap in favor of females is reduced considering the top performers, we also know that the geographical area, the origin of the pupil and the family background are main factors on performance: all these assumptions are already confirmed by the descriptive statistics provided. The proposed models, that is when we check on the basis of the proposed explanatory variables, however, also suggest other reflections: the geographic area remains influential but the north-south gap drops considering the top performers; the family background has a lower effect, the origin of the pupil becomes almost irrelevant, while the desired qualification and 8th Grade test score have the most influential odds ratios of all. Regarding gender, an interesting result also emerges: if we check with respect to the other predictor variables, the effect in favor of females in Italian language almost disappears (odds ratio around 1), while that in favor of males in Mathematics remains strong. In other words, considering those students reaching the last high school year without repeating, with the same demographic and social conditions, same school results in Grade 8th and same qualification desired, a male student is twice as likely to reach a level at least equal to '3' (sufficient) or at least equal to '4' (top performer).

Andrea Bendinelli, master degree in Statistics, he works at INVALSI's Statistical Service. He carries out statistical analysis activities on large databases and conducts research activities in the assessment of students learning.

Michele Cardone, degree in "Statistics for demographic and social sciences" and Master (I level) in 'Statistics for the management of information systems' (Università di Roma "La Sapienza"). Working for INVALSI since 2004, part of the Statistical Services since 2010, mainly involved in the analysis of the school tests data and in the management of the annual data return to schools.

Patrizia Falzetti, is the head of the INVALSI Statistical Department, manages the acquisition, analysis and return of data concerning national and international tests to schools, stakeholders and the scientific community.

Math gender gap according to socio-economic background in Italy: the better the conditions the larger the gap?

Cecilia Bagnarol - Patrizia Giannantoni - Veronica Pastori

Literature. Educational studies have extensively documented the existence of persistent gender inequalities in school performances, already from the first grades of primary school, with a specific disadvantage in Math for girls.

Two strands of explanations have basically been proposed. A first is oriented to biological factors, such as different cognitive strategies, whereas the other emphasizes the effects societal factors, particularly on how girls are socialized into believing that Math is not important, useful, doable, or part of the identity of a girl. However, both perspectives fail in fully explain the phenomenon: the biological because it cannot explain why differences are smaller in more gender-equal countries, the societal because it is in contrast with the evidence that gender gap does not decrease in context with better socio-economic conditions.

In addition, an interesting perspective is to consider jointly more than one source of inequality in a cumulative advantage/disadvantage effect.

Objective. This research was directed to explore differences in gender gap in 5th Grade of primary school in Italy, according to the different socio-economic background of students.

We wanted to test whether the gap between boys and girls could be larger for students coming from low SES, as they experience a lack of home support and stronger cultural influences reinforcing gender stereotypes or it could be larger for students with a high SES, as it was already shown by recent studies (Di Tommaso et al., 2020) for reasons not clearly identified yet.

Furthermore, we observed the trend of these differences from 2009-10 to 2018-19, to detect whether the trend is directed towards a reduction of these gaps or rather to an increase.

Data. We used INVALSI population data in Math test for students in 5th Grade of Italian school system. We intended to look to socio-economic background both with an overall indicator (ESCS) and with the specific variable mother's educational level.

With the aim of identifying whether is there a trend over time, we covered the period from 2009-10 to 2018-19. Afterwards, we focused our attention on the year 2017-18: the year with the largest differences between girls and boys. For the school year 2017-18 we matched Math test data with INVALSI Student's questionnaire data, deriving attending nursery school and feeling anxiety before Math test. Eventually, we introduced also the score at INVALSI Math test in 2nd Grade of school in the school year 2014-15. This allowed us to take into account the "baseline Math skills" of the students and we could look more specifically to what operates on gender gap in the period between Grade 2nd and 5th, net from the gap already existent at the beginning of primary school.

Methods. Descriptive trend of gender gap over ten years was illustrated, both the overall trend and the trend by socio-economic categories.

We also made use of geographical representations of gender inequalities at regional and subregional level. In the second part we focused on the academic year 2017-18, where we performed a more in-depth analysis of gender gap, using also a geographical variable (region and province). In addition, only for 2017-18 we run linear regression models using the following variables: gender, ESCS level (quartiles), geographical area (North East, North West, Centre, South), attending nursery school (yes/no) and feeling anxiety before Math test (A lot/Enough/Few/ Not at all). We built up nested regression model in order to study the effect of each covariate and its changes when we introduced new variables. Particularly, we considered in the analysis interactions terms of gender with the other explanatory covariates to detect whether the effect of being a young girl is more detrimental among the less/more advantage categories.

Results and Discussion. The general trend over the decade shows a consistent girls' disadvantage in Math performance independently from the scoring method used (percentage or WLE score), reaching the largest gap in the school year 2017-18. By looking to the same trend, splitting students into four categories according to their socio-economic background we found an increasing differential between boys and girls as the SES conditions improve.

Results of this kind have already been shown in literature (Contini, Di Tommaso and Mendolia, 2017; Fryer and Levitt, 2010; Lubienski et al., 2013) however a clear interpretation of this inverse relationship has not been found yet.

We decided to better investigate this result by extending the concept of "favorable conditions". We looked at territorial differences in gender gap across macro-areas and found that regions with the highest average Math scores showed also the highest level of gender inequality (Giofrè et al., 2020).

Findings from socio-economic and territorial analyses seemed to give the same indications: when the external conditions improve, the differences in the performance between boys and girls improve as well. Thus, we formulated the hypothesis that "the better the conditions the larger the gender gap". A possible reason for this effect could lie on different cognitive strategies and abilities between girls and boys that become more evident when the average performance improves, i.e. among top performing students. In such group boys manage reach the highest scores more than girls.

We finalized the research through an analysis with nested linear regression models, in order to look at our hypothesis in a more systematic way, considering the effect of all the available potential determinants of gender inequalities jointly and in interaction with gender. These models highlighted how girls perform better than boys in difficult conditions, whatever the typology of disadvantage, however, this trend reversed as the conditions improve and worsen gradually until it reaches the maximum disadvantage for girls in the most favorable conditions.

Cecilia Bagnarol, graduated in Statistics, Economics and Business to Alma Mater Studiorum University in Bologna. She is part of the Statistics Office of INVALSI, working primarily on statistical analysis on large database from National and International surveys.

Patrizia Giannantoni, PhD in Statistics and Demography from a multinational program with University of Rome and Lund and Max Plank Institute in Rostock. She has worked on psychometric evaluation of

developmental tests in collaboration with CNR and University of Parma and participated in research projects on migration as research fellow at University of Naples.

Since 2017 she has joined the Statistics Office of INVALSI, keeping her research interests on migrant integration, and educational inequalities.

Veronica Pastori, PhD in Methodology of Social Sciences. Her main interests of research are social inequalities, migratory phenomena, evaluation of educational processes, data quality and construction of standardized questionnaire. Currently, she works at the Statistics Office of INVALSI.

THEME 3. INVALSI DATA: A TOOL FOR IMPROVING TEACHING AND FOR EVALUATING

TRANSVERSAL SKILLS Organizer: INVALSI Coordinator: Michela Freddano February 27th: 16.15- 18.30 {Room Maria Montessori - Teaching 7}

From INVALSI data to cinema language. An online innovative path during the lockdown, searching new strategies for a more effective teaching method Daniela Ruffolo

Analysing the 2016-17 INVALSI Italian language results and the social-economical background of a second form in Don Milani Primary school of Giffoni Valle Piana (Salerno), considering that since 2018-2019 school year that class has hosted a foreign pupil with a poor knowledge of the Italian language and some pupils who showed social and emotional difficulties (with consequential low self-esteem, poor lexical competence in Italian language, and in a case strong emotional difficulties causing selective mutism), last school year, as the students were going to leave primary school for the middle one, Don Milani school experimented an innovative teaching education practice.

It combined the main cultural resource of the territory, the Giffoni Film Festival, with a MIUR/MIBACT fund called Cinema for Schools - Visioni Fuori Luogo – for the school project "How many moods in foods!".

The project was put into action online during the lockdown, in cooperation with other two schools, CPIA Salerno with its adult foreign students (for the implementation of Italian L2 competence) and the middle school pupils of Patroni Comprehensive school in Pollica, home to the Mediterranean Diet.

The pupils/students were the main actors in building up their competences through the cinema language, overcoming physical and emotional isolation and turning their homes and territories into a learning environment.

The results gained were not only related to Italian language competence but also to the development and reinforcement of transversal skills, such as inclusion, Civic competences, Health and Food education and soft skills.

The final product was a short film entirely made by students and mostly carried out in distance learning modality.

Daniela Ruffolo, has been School Principal of Don Milani Primary School in Giffoni Valle Piana (Salerno) since 2010. Graduated in Russian language and literature, she taught English in secondary schools from 1994 to 2010. She is a PNFD teacher trainer, member of the School Principal Evaluation Boards in Campania and Molise region and Auditor S.A.P.E.R.I. School Quality Label.

INVALSI standardized assessments and Distance Learning: educational paths in a formative perspective Chiara Giberti - Antonella Castellini - Federica Ferretti

In 2020, the pandemic crisis triggered by the epidemiological spread of Covid-19 hit the whole of humanity hard. The Italian population, and beyond, has been forced into rigorous lockdown with severe consequences on social and psychological life and, consequently, also on education field. This emergency has highlighted the strengths and weaknesses of the existing educational systems. Although the pandemic has affected all countries, their school systems have been affected in different ways and with different hints, and the repercussions on the various educational systems have been characterized by specific peculiarities. In Italy, this interruption of in presence teaching has affected millions of pupils from the Kindergarten to the University; even today in most schools, where possible, mixed didactic is implemented (partly in presence and partly at a distance). In the national and international panorama of research in Mathematics education,

more and more reflections and debates are emerging on the topic: there is a strong and shared consensus on the need to rethink Mathematics teaching starting from reflections on the impact it will have on teaching practices future this period of forced Long Distance Learning (LDL). During the emergency period, schools and universities changed their physiognomy in terms of social interaction, practices and identity of the individuals involved. Thanks to digital technologies, schools and universities have been able to overcome the physical distance imposed on teachers and students and guarantee - albeit in different ways and with strong imbalances on the territory mainly due to socio-economic and social factors - the conduct of lessons. This sudden change had a strong impact on all aspects of the school system and teaching, also impacting on one of the most critical issues for the Italian school: the assessment. Due to factors of different nature, traditional assessment practices (for example, written assignment, questioning on the blackboard, etc.) were not implemented in most of the virtual classrooms. This phenomenon has forced a strong change and required to rethink the assessment process: issues related to the creation, administration and measurement of assessment tests have been at the center of shared issues for all school Grades and nationwide. In this contribution we will show how reflections and examples of didactic activities, born from macro-phenomena that emerged in the INVALSI standardized assessment and from the Rally Matematico Transalpino (RMT) tasks' analysis, have led to the establishment of formative assessment situations in Mathematics. In particular, we will analyze the activities proposed in training courses carried out during forced LDL involving about 2,000 Italian teachers.

The educational paths arise from reflections on the analysis of the tasks from the INVALSI first-cycle Mathematics tests and from the RMT and, as we will see in detail, their achievements in the virtual classrooms have conveyed didactic and assessment plans in a formative perspective. In detail, the two didactic paths were presented to teachers during teachers professional development courses implemented online and each didactic path was created by the expert themselves in such a way that they can be used directly by the students of the teachers involved. During the online webinars, the activities were presented and framed with the theoretical lenses of Mathematics education and suggestions for their implementation were provided. The two paths we will consider are "Decomposing a square: towards the Pythagorean Theorem" (Activity 1) and "Vertices, edges and faces: polyhedra and toothpick" (Activity 2). Both refer to visualization skills: activity 1 is inspired by problem of Rally Matematico Transalpino and investigates 2D visualization skills while the second activity transforms INVALSI questions from the Grade 2, Grade 5 and Grade 6 Mathematics INVALSI tests into manipulative activities aimed at investigating spatial visualization skills. The response of the teachers was extremely positive and both activities were considered to be well developed in an emergency situation and therefore implemented within structured courses in LDL contexts. The feedback collected by the teachers highlighted how the two paths stimulated the research for different solution paths which also resulted in the concrete creation of materials (for example biscuits). Analyzing the activities carried out, it was also observed a motivated participation of pupils who rarely actively participate in classroom. Positive feedback was detected not only by students but also by teachers: the teachers declared that the realization of the proposed paths allowed them to become aware of the characteristics of their teaching in an emergency situation and offered them food for thought on the traditional didactic choices proposals in classroom practices.

Analysing the work done by the students, their motivations, their materials, allowed teachers to reflect on the learning processes of their students, giving to the word assessment not the meaning of "judgment" but the meaning of researching information on learning in order to detect strengths and weaknesses to improve teaching itself. From this qualitative study it emerged that the realization of didactic paths, accompanied and guided by experts in Mathematics education, has conveyed situations of formative assessment during the emergency period, favoring it over the summative assessment often predominant in traditional Italian assessment practices.

Antonella Castellini, graduated in Mathematics, has been involved in teachers' professional development paths for the first cycle since 2006. She holds two masters for trainer in Mathematics education. She's tutor in M@t.abel, PQM, VSQ projects and TFA coordinator tutor. Author of numerous papers, she carries out research-action activities at an international level in the ARMT and winner of the Cotoneschi Prize. She

collaborates with the Future Education Modena center for innovation in the educational field for the M@at.abel 2020 project.

Chiara Giberti, Phd in Math education and researcher at the University of Bergamo. She collaborates with INVALSI and her research interest focuses on the potential of standardized assessment in Mathematics education research. She's also a Mathematics and science teacher in middle school and she collaborates with the center for innovation in the educational field Future Education Modena.

Federica Ferretti, PhD in Matematics. She is Researcher in Mathematics Education at the Free University of Bolzano-Bozen, Faculty of Education. Her main research interests concern the Didactic Contract at all school levels, formative assessment in Mathematics and the formative use of standardized assessment. For years she has been involved in Mathematics teachers professional development.

INVALSI data: a laboratory for orientation Ileana Ogliari - Andrea Guarnacci - Mariarosaria Orefice

The national guidelines for lifelong guidance underline the "centrality of the school system... [as] an irreplaceable place in which every young person must acquire and strengthen the basic and transversal skills for guidance, necessary to develop their own identity, autonomy, decision and planning "(Miur, 2014). It is clear that such a declaration of intent determines the necessity for each school to design a program that is successful in the transition from the planning to the implementation phase. In particular, the definition and practice of a didactic orientation that accompanies the student to build, in a gradual but conscious way, the realization of oneself as an active (and responsible) citizen of tomorrow is considered a priority. This need is even more pressing in the transition from lower secondary school to upper secondary school, that is, when the student is faced with crossroads that can have a decisive impact on his/her future career as a worker. From this point of view, the analysis of the data returned by INVALSI constitutes a piece of absolute value in grasping - from primary school - which basic skills are to be stimulated, consolidated, and strengthened. Not only that: the construction of a student's curriculum dedicated to results in standardized tests allows one to "read" the profile in a more complete way, allowing to pay more attention to those transversal skills that are not fully exploited in the teaching of today. This contribution starts from this premise to tell a school experience that proposes an organizational system of flexible hours such as to offer each student laboratory activities capable of promoting the progressive awareness of their own aptitudes. Within each of them, the national surveys - and the data obtained from them - play a central role: the guide to reading the test provides the privileged ground for analyzing the items, subdividing them into specific areas and aspects, grasping the critical issues or strengths detected by the results, finally designing work paths that start from these. At the I.C. "Manfredini" in Pontinia (Latina), a working group has been operating for years and is entrusted with the task of analyzing the data returned by INVALSI to verify not only the results of the tests, but - above all - the levels of competence recorded by the students. This allows to remedy the failure to return the answers of the students in the CBT test of the third class of the SSIG. Reading the results of each of them in the five levels described by INVALSI offers teachers the opportunity to understand which areas of their didactic planning are adequately supervised and which, on the contrary, are lacking the necessary correspondence by the learners. In both cases, it will therefore be possible to intervene with learning units based on practical-laboratory activities that are inspired by such evidence. Think, for example, of the Space and Figures area of a Mathematics test in which the student is asked to connect a representation of a three-dimensional object with its schematization. In the face of a particularly negative outcome a manipulative activity is proposed in which the goal is to design and build concrete models of various types. Making use of tools not typically used in teaching - such as Lego bricks - constitutes a plus which, through the game, provides the systematic observation of the teacher, a different and privileged perspective to grasp transversal skills with the objective to increase eagerness to learn. In the Italian tests there are critical issues related to the vocabulary and, more generally, to the argument, especially in the presence of open-ended questions. Therefore, activities were designed and implemented with the aim of reducing the margin of error by using different tools and languages: finding the right words to "translate" the emojis that characterize the language of social media or solving a series of logic games by pushing the

students to explain - verbally and in writing - the process supporting the achievement of the goal. It was thus possible to make the learner understand the transformations over time and the extraordinary potential of the instrument through which they are expressed. An approach of this type - which holds together disciplinary contents and skills - has the ambition to foster autonomy, self-confidence, ability to plan and organize, while stimulating precision, attention to detail, ability to achieve goals, capability to work in groups and solve problems. It is, in other words, an effective method to develop the necessary soft skills for a learning that lasts a lifetime. The INVALSI data confirms its didactic function: it supports schools in defining strategies and working methods, it is instrumental in guiding students in their transition from middle school to high school.

Ileana Ogliari, graduated in Italian Language and Literature at La Sapienza University in Rome, is a tenured teacher at the Lower Secondary School "Manfredini" in Pontinia, where she was person in charge of POF (Educational Policy Plan), Headmaster's collaborator since the school year 2013-14 and member of the Internal Evaluation Unit.

Andrea Guarnacci, graduated in Italian Language and Literature at RomaTre University, is a tenured teacher at the Lower Secondary School "Manfredini" in Pontinia, person in charge of assessment and school self-assessment since 2012-13, member of the Internal Evaluation Unit and the Didactic Commission, teacher trainer in the Territorial Area 23.

Mariarosaria Orefice, graduated in Mathematics at the University of Naples, is a tenured teacher at the Lower Secondary School "Manfredini" in Pontinia, where she is in charge of the logical-mathematical area, coordinator of the INVALSI Commission, member of the Internal Evaluation Unit.

Skills objective Annamaria Romano - Giovanni Pucciarini

This work intends to investigate the possible relationships between INVALSI tests and skills, especially the transversal ones, as the analysis of the results of national surveys, in addition to representing a useful tool for research on schools, can also be configured as an opportunity in school to activate a critical reflection on evaluation processes and models, laying the foundations for an effective improvement action aimed at training future competent citizens and workers. Schools, today more than ever, are required to strive to ensure that everyone possesses the basic and transversal skills or soft skills, which constitute the light baggage, to which everyone can, from time to time, attach knowledge and the skills useful for that stretch of road in that precise period of one's life.

What tools can be used to ensure that each student has become truly competent?

The INVALSI tests, having the mandate to evaluate and certify skills, represent, together with the school evaluation, an excellent tool to ascertain their acquisition by our students. The starting point of the research was to investigate what relationship may exist between the results of the assessment and certification of skills made by the INVALSI at the end of the first cycle school and those carried out by the school. We then went on to analyze how much the acquisition of soft skills is functional to an improvement in INVALSI outcomes. The results that emerged became an opportunity for reflection among teachers in order to favor the composition of a new educational scenario aimed at improving the process of teaching-learning.

Annamaria Romano, is a primary school teacher at Istituto Comprensivo Perugia 6. She is member of the staff for Institute Evaluation and Self evaluation area. She is apprentice's tutor at the Department of Educational Science of University of Perugia. In her institute she is corporate teacher and promotes trials in the logical and mathematical area. She contributed to Umbria USR field trials on Learning disabilities. *Giovanni Pucciarini,* is a First Grade Secondary School teacher at the Comprehensive Institute of Perugia 6 where he acts as Deputy Director.

Duties and honors. Professionalism in teaching and appropriate didactic choices Daniela Nuzzo - Maria Teresa Capone

The paper intends to report the steps taken by the network of Incantiere schools, after the intervention in the IV INVALSI Seminar, with respect to the definition of common good practices, teaching professionalism and results, in the context of teaching Italian language and literature. In relation to a year as anomalous as it was unimaginable for schools, such as the school year 2019-2020, in the absence of national surveys, we review the ways in which the network has continued the collection of data, experimental research and the sharing of good practices and results achieved.

The object of the research is the activity of a network of schools which, in its three-year project proposal, aims to open spaces for discussion between teachers on teaching strategies and methodologies embraced, to build a path of professionalization of teachers also through good practices shared and disseminated, to follow innovative ways of teaching Italian language and literature, particularly favoring reflection on the feasibility, scalability and replicability of the Writing and Reading Workshop method in Italian schools. The hypothesis around which this paper particularly focuses is that the public recognition of teaching professionalism affects both the legitimacy that the teacher gives to the chosen method and the enthusiasm and passion transferred to the students in the classroom context; from here, the survey expands to reflect on which detection tools could usefully be used to assess the validity of a method regardless of the "effetto docente."

The data used are: observations, surveys, school results, surveys of public actions of the teachers involved. This is accompanied by a survey of the monitoring tools put in place by the various educational institutions "in the absence" of the results of national standardized tests for the school year 2019-2020.

Proceeding through case studies, the results that will be described on the one hand will allow the relevance and urgency of an open debate on teaching professionalism in Italy, on the other hand they will support the validity of the Writing and Reading Workshop also in different and complex contexts.

Daniela Nuzzo, teacher of literary subjects in high schools, PhD in "Historical and Philological Sciences", paleographer, archivist, trainer, cultivates interests and curiosities in different fields: evaluation, teaching, ICT. Involved in implementation projects of the national evaluation system, passionate about fine literature and literature, she follows and coordinates projects dedicated to the promotion of reading and writing; she is the contact person for the network of Incantiere schools.

Maria Teresa Capone, Old Latin and Greek teacher, since 2013 she is H.T. Passionate about literature and fan of Euripides and Dylan Dog, she has always taken the interest in new technologies and didactic innovation with her. Attentive to the issues of evaluation and self-evaluation and the enhancement of teacher professionalism through quality training courses, she has promoted innovation and school networks.

Let's learn with Ghiandina Maria Brutto

The laboratory, in support of the fable, wants to promote a conscious and participatory reading of the text, offering itself as a teaching tool for the use of the teacher attentive to the assessment of the learner's language skills, in order to orient and reorient the teaching process learning.

In this case, the narrative text offers itself a privileged opportunity, capturing the attention of the budding reader, to stimulate opportunities for silent reading, reading aloud, dramatized reading, problematic reading. Problem poning is a sine qua non to facilitate the acquisition of greater awareness of a real context or created by the writer's imagination and thus mobilize the emotional and intuitive intelligence that allows the reader to place himself in the story.

The main objective is to grasp the teaching underlying the story, making it the object of reflection and a starting point for the dialogue that the teacher will want to engage in.

The young reader is asked to refine language skills in self-assessment or to facilitate the assessment of the level, by answering a battery of 20 questions per chapter. The questions are based on the INVALSI tests model, whose framework encodes the contents and aspects that the test intends to verify in relation to pragmatic-textual, lexical and grammatical competence, then articulating it into sub-competences. Each set of questions proposed is associated with a specific competence identifiable in the National Indications for the school curriculum of the first cycle of education, which recognize reading in addition to aesthetic pleasure, the intellectual taste of searching for answers to questions of meaning useful to activate cognitive processes of understanding the text, from the identification of information, to the interpretation of logical conceptual passages. A semantic-lexical reflection follows also through the study of lemmatization as well as the correct reading of the information deducible from the gloss on the vocabulary. Finally, the knowledge of basic grammar and spelling elements required of the recipients of the fairy tale is required.

Maria Brutto, was born and lives in Catanzaro. She graduated in classical literature in Catania. He currently directs the IC G. Bianco in Sersale. Also qualified in history and philosophy, she considers culture in its holistic sense. Regional evaluation expert, multi-year planner in PON actions, speaker at national cultural conferences.

What Italian secondary school teachers tell us about teaching in a mixed language classroom. Implications for future teachers Gustavo Lanata

The research aims to collect information from teachers about how they succeed with the multi-level, multilingual and multi-ethnic that make up many of today's Italian state school classroom. The presentation is about work in progress that is being conducted using a Phenological research approach. This approach allows teachers to speak and be heard in an unobstructed manner. The approach was selected because it allows the researcher to learn from the experience lived by the participants (Creswell, 2009). We expect the results of this research to provide guidance and direction to both future teachers and academics interested in the topic.

The end of the 20th century and the first two decades of the 21st century have seen Italy become an immigrant receiving nation. Today one in ten Italian residents was born outside of Italy (Contu, 2019). What new challenges does this presents for the Italian classroom teacher and what role does INVALSI play in addressing these challenges?

Data for this presentation is based on an extensive literature review and a critique of works including Immigrant background peer effects in Italian schools (Contini, 2013), International Migration Report 2017: Highlights United Nations (UN, 2019), Teacher Education in Italy, Germany, England, Sweden and Finland (Ostinelli, 2009) and Preparing Culturally Responsive Teachers: Rethinking the Curriculum (Villegas and Lucas, 2002).

The presentation concludes with a discussion of the challenges faced by Italian teachers and how can data collected by INVALSI contribute to inform strategies to addressing these challenges. The results obtained from this study seek to add to the scholarship that considers the authentic voice of the teachers. In doing so, I intend to gain feedback from experts and practitioners attending this conference.

Gustavo Lanata, studies at University of Bath, UK.

#Ita L2 Network project: "Italian for foreigners: a language for study" Daniela Mercante - Marinella Pitino

The network project "Italian for foreigners: a language for study" arises from the need of the 8 schools involved to seek solutions and promote effective and efficient responses to the phenomenon of the educational emergency in the Victorian area. Specifically, the project aims to intervene in the pockets of fragility, linked to students with a migratory background, by sharing teaching methodologies and operational strategies that aim to enhance and consolidate the broader panorama of school inclusion experiences.

The network, thanks also to the support of the university world, aims to strengthen and implement the tools to support governance (reception protocols, personalized transitional study plans, linguistic - sociometric and cognitive tests, language teaching kits, etc.) and to hoard good practices didactics on the scholastic inclusion of pupils and students with non-Italian citizenship also as a function of the increase in school results.

The aim of the project is to act beyond the emergency logic of the welcome and the first school placement, linked to learning Italian to communicate "and aimed at newcomers, to intervene and support long-resident immigrant students, in the study, in the orientation to school choices and in the accompaniment to educational success. As stated in the 2014 Guidelines for foreign students, "the time has come to qualify the specific didactic intervention aimed at non-Italian-speaking students to better accompany and support the linguistic development of foreign students born in Italy or inserted for some time, and to allow them to master the language and its functions in a full and rich way: to narrate, describe, define, explain, argue, etc.; in parallel with a continuous reflection on the language that allows full control". The didactic qualification intervention, implemented by the network, started with the reading of the results of the national tests which highlighted the profound link that exists between the reduced linguistic competence and the emerging difficulties in learning. The analysis of the data by origin also made it possible to highlight the general tendency of foreign students to achieve lower results in the Italian language and Mathematics tests than indigenous students even with equal social and economic conditions; trend also confirmed by the national data, started by reading the results of the national tests which highlighted the profound link that exists between reduced linguistic competence link that exists between reduced linguistic competence and the emerging difficulties in learning.

In particular, in the schools of the network, there is a massive, sometimes exclusive, presence of foreign students in level 1 relating to Italian language competence certified by INVALSI at the end of the third grade of upper secondary school and the low variance of results between pupils first generation and second generation. From this consideration arises the need to operate, also through the use of specialized personnel hired by GPS, to support foreign students to avoid the so-called "floor effect" and to put at the center of the path the acquisition of linguistic-communicative skills for the study, essential for the promotion of the person and equal opportunities. The support of the university world was achieved through training/information actions aimed at class councils, curricular educational support actions carried out through the figures of trainees and undergraduate students, extracurricular educational support actions to support the study carried out through the TOL (internship online training) coordination and didactic orientation of the specialized personnel involved. The didactic intervention, carried out in a highly inclusive logic, involves all students in the class and assumes a transversal cut to the study disciplines, with the aim of providing/deepening language skills and tools that can have a positive impact on the whole context;the non-Italian-speaking pupil learns Italian to study, but also learns Italian by studying, through typical paths of development of writing and reading/comprehension skills of texts designed starting from the reference frameworks of the INVALSI Italian language tests administered in the previous years. This "Ponte phase" or

access to the Italian study represents a delicate and complex phase, as the student begins to consolidate the knowledge of the Italian language, to study and understand the contents of the other disciplines and starts to develop the skills necessary to participate in common learning in the classroom. The project also included interventions aimed at situations of illiteracy and low literacy (NAI) implemented through strategies capable of reaching even the most vulnerable users through small group "language laboratories" during curricular hours according to the integrated model.

The project also aims to: - improve the academic results of foreign students; - try to reduce the discrepancies of intervention that are noticed from school to school to make the linguistic intervention functional and raise the results; - introduce quality criteria with respect to L2 teaching; - experiment and monitor L2 interventions in schools, to evaluate the results and make them, in a second phase, widespread action and to be brought "to the system"; - provide for system actions, monitoring, documentation, communication of the results and materials produced.

Daniela Mercante, is a school manager who is an expert in self-assessment and external evaluation processes and has collaborated with INVALSI as an external evaluator; project coordinator.

Marinella Pitino, is a primary school teacher, PNFD expert trainer in the areas "Teaching by skills" and "Inclusion and disability", Italian L2 teacher.

Are the INVALSI tests useful in changing approach to language implementation in the school system? The evidence of Italian schools using Slovene language as first school language in Friuli Venezia Giulia region Elisabetta Kovic - Alessia Cividin

The research deals with the case study of Italian schools using Slovene language as first school language in Friuli Venezia Giulia region.

It is related to the evaluation of students coming from INVALSI tests of 2015 and it underlines the performances of students in the tests dealing with Slovene mother tongue and not Slovene mother tongue, in different types of task content and subjects (comprehension and use of language, Maths).

Can actually the INVALSI test be the lift for a changing approach in school's first language implementation? The analysis is based on a sample of schools using Slovene language as first school language in 2nd, 5th, 8th and 10th Grade and outlines linguistic differences in the regional territory, moreover it suggests additional information about the importance of a motivational approach in learning another language spoken in the Region (referred to Slovene ethnic minority). It has been found that students' performances and full language functionality are affected by students' attendance in the long term period. The present study aims to complement the teaching activity, the dynamic approach between Italian and Slovene language and to provide useful issues for items and test assessment.

Elisabetta Kovic, is a school director, in charge of the USR of the FVG, for carrying out the tasks related to the implementation of school autonomy in the Special Slovenian Language Office for the two school year 2020-2021 and 2021-2022. In particular, she deals with support for educational research and teaching for Slovenian language schools.

Alessia Cividin, is a first grade secondary school teacher, in charge of the USR of the FVG for the academic year 2020-21, PhD in territorial planning and public policies. Her research interests concern intercultural contexts and teaching methodologies for learning in technological environments.

A Case Study. Does music help to learn Maths and promote success at school? Bruno Chiozzi - Daniela Sartor - Rita Tegon

This work was inspired by Neuro Science research which highlights that human brain can be influenced by exposure to Music over long periods of time. For instance these studies show that "many neural pathways

for cognitive processing, partly overlapping for different fields, are highly overlapping as for the musical and mathematical field which, in turn, are connected with different aspects of emotion". (D.Olivieri, Neuroscientific studies on Mathematic cognition and music listening from childhood to early adulthood, the state of the art. 2011).

Therefore, Music and Maths are a fundamental combination to develop cognitive skills of students from the first years of education.

Starting from this assumption, we took into consideration the context data, the INVALSI results in Maths and the distribution in learning levels of the students of Musical Course classes in a first-grade Secondary School. The aim of this work is to observe the behaviour of the variables taken into consideration to check if they confirm what is written in the introduction.

Music motivates, involves and fascinates.

Therefore, in an innovative perspective, can the musical workshop be a teaching methodology to learn Maths, develop skills and promote educational success of all students, both from an upper-middle background and from socio-cultural disadvantage?

Bruno Chiozzi, is an Italian Language and History teacher (A012); in 2018-2019 "seconded" teacher employed in Belluno Area Office in charge of province teacher training, CLIL, English at Primary School and PNSD (Italian national Plan for Digital Education); since 2019-2020 "seconded" teacher employed in Veneto Regional School Office in charge of regional PNFD (National Project for Teacher Training), CLIL and "Small Schools"; listed in the Professional Trainers Register (RFP) n. 1012 of Italian Trainers Association.

Daniela Sartor, is a Primary School teacher; in 2018-2019 "seconded" teacher employed in Belluno Area Office in charge of Young Apprenticeship programs and Work- related learning activities, Education and Career guidance, Prevention of School Drop-out; since 2019-2020 "seconded" teacher employed in Veneto Regional School Office in charge of SNV (National Evaluation System) and INVALSI; Consultant for INDIRE improvement; listed among Veneto Region experts to support and train schools towards the National Evaluation System.

Rita Tegon, is a teacher of Humanities, Latin and Greek; NEV (member of the external evaluation boads) with INVALSI; consultant for school improvement with INDIRE; expert in methods and improvement processes for USRV (Regional School Office Veneto); trainer in Italian National Plan for Digital Education (PNSD).

Study of the performance of students from the Marche region in Mathematics (Grade 2-5-8-10-13) in the five-year period from the s.y. 2013-14 to the s.y. 2018-19 with reference to parameters such as gender, origin and regularity Carmina Laura Giovanna Pinto - Anna Laura Gasperat

The study of the characteristics of students in the Marche Region with particular reference to parameters such as gender, origin and regularity wanted to highlight the impact they had on the results of the INVALSI mathematical tests in relation to the development of competence levels in the passages analysed: 1. from the second primary class (s.y. 2013-14) to the fifth class (s.y. 2016-17); 2. from the primary fifth class (s.y. 2013-14) to the third low secondary class (s.y. 2016-17) and from the latter to the second class sec. second degree (s.y. 2018-19); 3. since the third class of low secondary class (s.y. 2013-14) to the second class of upper secondary (s.y. 2015-16) and from the latter to the fifth class of upper secondary (s.y. 2018-19). At the end of the study it will be highlighted what progress, if any, has been achieved as a result of projects and actions implemented by the various educational institutions in the school years 2013-14 to 2018-19 to promote the process of school inclusion by promoting the development of competence levels in Mathematics.

Carmina Laura Giovanna Pinto, is teacher of Mathematics and Physics, commanded at USR Marche since 2015 and PhD student in the second year at UNICAM - School of Advanced Studies Area Science and Technology and Curriculum Mathematics. She has always dedicated particular attention and study to

difficult situations in Mathematics teaching and has always been committed to making the current discipline is easy to understand, whatever the conditions of entry of the pupil and therefore regardless of his personal characteristics and socio-family context.

Anna Laura Gasperat, graduate in Physical education and Sports Sciences and specialized for supporting educational activities in the classroom with students with special needs. In 2018 she obtained a master's degree in Organization and Management of Educational Institutions in multicultural contexts. Teacher and professor of motor activity teaching in the Department of Educational and Educational Sciences of the University of Macerata, she has gained experience leading complex organizations in sports and educational experiences of teaching and recovery of learning difficulties and school dispersion in the secondary public school. Since 2015 posted to the USR Marche for the coordination of national health and safety projects and projects for cross-skills and guidance. Since September 2020 in charge of school inclusion for the province of Ancona.

Strategies for better or for worse, with progressive skills, for the resolution of questions INVALSI Ivan Graziani - Stefano Babini

What are the strategies that students put in place when they have to answer a question? What skills do they try to put into action when faced with a multiple-choice question to find the right one and what leads them to choose the wrong one instead?

To try to answer these and other curiosities about how students act "for better or worse" to answer the INVALSI questions, we conducted a vertical research between the first and second cycle.

We assembled a small booklet with three questions, selected through the Gestinv website (www.gestinv.it), which was then administered, thanks to the help of some teachers of the Emilia Romagna Region, to students in the third grade lower secondary school classes and in the second and fourth grade upper secondary school classes, technical and professional.

We chose two questions on Relationships and Functions, Grade 8, one with a justified answer and the other with a true/false answer, and a question on Data and Forecasts, also Grade 8, with a multiple answer.

In our work we have considered, according to the National Indications for the first cycle and the INVALSI Reference Framework, mainly the questions that concerned the dimensions of "Knowing" and "Solving problems" and only for the first question the dimension "Debate".

The aim of our research was to verify which strategies the students put into play to answer different types of questions, in a correct way, but also by making mistakes.

The students of our sample of the first cycle institutes are from the provinces of Bologna, Forlì-Cesena and Ravenna, while those of the second cycle are from the provinces of Bologna, Forlì-Cesena and Parma.

We carried out an analysis of the data obtained, focusing both on the correct answers and on the errors of the wrong ones, and a comparison with the results of the national sample, always found in the Gestinv site, in the different classes to which the mini-file was administered, to check the verticality of learning.

The advantage of using a non-random sample then allowed us to involve students through their teachers and analyze the questions, in a laboratory way, to analyze with them what dynamics could have a positive outcome and what instead led to the error.

With some classes of our sample we were able to ask students to try to identify the causes of some errors, also trying to defuse the error and trying to build competence also starting from wrong answers.

Ivan Graziani, teaches Mathematics and Science. He is an educator in Mathematics didactic. He is dedicated in ICT, problem-solving and didactic communication. He is a member of GRSDM of Pisa (Group of Research and Experimentation in Mathematics Didactic) and "Divertical-Math" research group. For many years he has been collaborating with UNIBO, INDIRE, INVALSI and Mondadori-Rizzoli Education.

Stefano Babini, teaches Mathematics and Physics. He is dedicated in problem-solving, didactic communication and new applied technologies in didactic. He works with processes of learning and evaluation in many different training and system contexts. He is a member of "Divertical-Math" group, which researches new Mathematics didactic methods. For many years he has been collaborating with INVALSI.

AGENDA 2030: SURVEY ON SUSTAINABLE DEVELOPMENT GOALS THROUGH INVALSI DATA

ORGANIZER: INVALSI COORDINATOR: BARBARA BALDAZZI FEBRUARY 27TH: 16.15-18.30 {ROOM CORRADO GINI - WORKSHOP 3, PART 2}

Immigrant performance towards reading in OECD PISA 2018 Paola Giangiacomo - Valeria F. Tortora

The number of immigrant students has grown considerably in the past 20 years in most countries. According to the OECD, around 4.8 million immigrants arrived in OECD countries in 2015, a wave that reinforced a long and steady upward trend (OECD, 2018). In OECD countries, between 2000 and 2009, the percentage of students of immigrant origin has grown by an average of three percentage points, in Italy the percentage of immigrant students has grown by almost 4.4% (4.1% second-generation immigrant students, 0.3% first-generation immigrant students).

Europe has always underlined the importance of promoting the integration of children and young people with migrant backgrounds in schools and facilitating their integration into society through education.

In Italy, since the beginning of the migration phenomenon, the school has taken shape as a place of integration, of cultural exchange, of meeting with languages and stories that are worth knowing and enhancing in common educational spaces.

Among the factors traditionally used by international literature to explain the educational disadvantage of first and second-generation immigrant students, elements of a socio-economic, institutional and nature linked to the migratory history of their family play a fundamental role. Among the most important explanatory factors of the school gap between natives and students of immigrant origin, a strong impact is given by the variable language spoken at home on the performance of students in general and even more on the performance in reading, in fact several studies show that speaking a language other than that of the test always involves, other things being equal, a decrease in the score obtained (Isphording and Otten, 2014).

The aim of the study was to investigate what reading skills first and second generation students, who participated in the OECD international survey, use. For the purpose of this paper, we included some variables of the OECD reports when presenting and discussing PISA 2018, cross-country differences and similarities in the performance and characteristics of students with immigrant background.

Our research hypotheses are: is the language barrier overcome if the test language is spoken at home? To explain the educational disadvantage of first and second-generation immigrant students, is it necessary to analyze the role played by the socio-economic aspects of parents? Are the territorial gaps also evident between immigrant students from the North and those from the South?

PISA 2018 shows that, in major school systems, first-generation immigrant students who spent more time in the destination country tend to perform better than those who spent less time in the country; whereas second-generation immigrant students tend to perform better than first-generation immigrant students but even worse than their non-immigrant peers; another results is that the most vulnerable immigrant students tend to be those who arrive late, who have a limited command of the evaluation language in the host country and who come from a country where education standards are weaker (OECD, 2019b).

Paola Giangiacomo, is a researcher at the National Institute for Educational and Educational Education Assessment (INVALSI), where she is National Manager for OECD. Her current research is in the field of Psychometrics and includes test development and validation.

Valeria F. Tortora, is a researcher at the National Institute for Educational and Educational Education Assessment (INVALSI), where she is National Manager for the International Association for the Evaluation of Educational Achievement (IEA). She is PhD in Comparative Education with a thesis on the use of OECD-PISA results by teachers to improve their teaching strategies.

INVALSI tests and the Italian territory: a comparison between native and foreign students of Grade 8

Jana Kopecna - Francesca Leggi - Maria Carmela Russo

In September 2015, the governments of the 193 UN member countries signed an action plan Agenda 2030, adopting a set of 17 goals as the blueprint for a global sustainable development. Eradicating extreme poverty, fighting inequalities and injustices are some of the goals that involved states have committed to achieve by 2030. Among these, goal number 4 aims to provide quality, equitable and inclusive education, and lifelong learning opportunities for all. The goal is then concretized into a sub-goal: to eliminate gender inequalities in education by 2030 and to ensure equal access to all levels of education and vocational training of protected groups, including persons with disabilities, indigenous populations and children in vulnerable situations.

The ISTAT's monitoring of the Agenda objectives places Italy among the last positions in Europe according to the number of graduates, dropout rates and skills. The separating line between Southern and Central-Northern Italy concerns a wide range of phenomena, representing an emblematic case throughout the European Union, and undoubtedly constitutes a leitmotif of economic and social research in the country.

The INVALSI National Learning Surveys point out that in the South there are not only less satisfactory results, but also a lower ability to ensure the same educational opportunities for all students.

The variability of results among schools and between classes, used as an indicator of the equity of the educational system, is higher in the South and Islands since primary school.

In addition to the analyses on the dynamics of divergence between macro-regions of the country, firstly along the North (or rather North-West) - South axis and then through analyses on Third Italy, in recent years, the attention has returned to the development trajectories within each region and macro-region in more analytical terms.

In this regard, the concept of inner areas seems to be an effective tool for understanding territorial differences. These areas represent that part of the Italian territory characterized by the significant distance from the centres of supply of essential services, often affected by a long process of demographic decline and economic marginalization.

Within this scenario, the growing presence of foreign students on the national territory reveals a condition of inequality attributable not only to linguistic difficulties, but also to the socio-economic background of the families of origin. These differences, in turn, decline geographically, with a greater incidence of the foreign population in the most dynamic and developed areas of the country. The research we propose follows this line, focusing attention on the gap between the learning levels of immigrants and Italian students. In this paper, we will study the difference between native and foreign students in the last year of lower secondary school (Grade 8) in the 2018-19 academic year with the aim not only to photograph the phenomenon as a whole, but to highlight the geographical areas of possible intervention, resorting to the joint use of different territorial levels.

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Francesca Leggi, degree in Sociology, specializing in Economics, Labour and Organizations. Currently working at the Statistics Office of INVALSI, focusing on the statistical analysis on large databases.

Maria Carmela Russo, PhD in Methodology of Social Sciences, works at the Statistics Office of INVALSI. Her research has focused on evaluation of tertiary education, indicators to measure violence against women in comparative perspective and marriage dissolution.

Targeting students with high risk of dropping out of school: a latent profile analysis Giuseppina Le Rose - Chiara Sacco

Literature. The 2030 Agenda for Sustainable Development launched by UN Member States in 2015 has a set of 17 sustainable development goals (SDGs). The SDG 4 aims to "ensure an inclusive and equitable quality education and promote lifelong learning opportunities for all". In the last years, a worrying problem that requires an appropriate and effective political response is the significant number of early school leavers. According to Eurostat data, the proportion of early leavers from education and training, i.e. young people aged 18-24 who had completed at most a lower secondary education, raised from 14% in 2017 to 14.5% in 2018. Italy is one of the countries with highest rate of early school leavers, only three countries in EU performed worse. Although the rate of early school leavers dropped of 4.1 percentage points from 2010 to 2018, rate of early school leavers in Italy remain far away from the EU average (10.6%). It is well known that the transition between lower and upper secondary school is a difficult and delicate step of the student's life. The demanding of more independent learning of more challenging education material can result in poor academic performance, in lack of motivation and engagement or in feeling of loneliness such that the student could drop out school early.

Objective. In this study, we aim to monitor the transition of the students between the last year of the lower secondary school (8th Grade) and the upper secondary school. We focus on the identification of the principal characteristics of the students at high-risk of dropping out, hypothesizing the presence of several high-risk students' profiles in terms of self-efficacy, demotivation, future expectations, relationship with parents and with peers and school performance.

Research Hypotheses. Dropout prevention programs are intervention designed to keep students in school and encourage then to complete the upper secondary school. Usually these programs target student at-risk and provide them several support services and activities. The crucial question for planning an efficient prevention program is "which are the characteristics that accurately identify students more likely to drop out"?

Data. We exploited the standardized tests and the answers to Student's Questionnaire, both administered by INVALSI in the school year 2017-2018 at the 8th Grade students. The 2017-2018 Student's Questionnaire collects information about the student's motivation for studying Italian Language and Math, the student's view about the school environment, parent's support, student's self-efficacy, student's relationships with the peers, student's future expectations and student's qualification expectations. In addition to the Questionnaire variables, we considered also the index of economic, social and cultural status (ESCS), the immigration status, the gender and the late-enrolled indicator. To monitor the students after the lower secondary school, we used the administrative data of student enrolment at Grade 10 in 2019-2020 to compute the binary indicator of drop-out risk matching the records at student level. The dropout risk indicator assumes value 1 if the 8th Grade student is enrolled in 2019-2020 on the second year of the upper secondary school and 0 otherwise. Thus, the group of students identified by the null value of the indicator of dropout risk are those with a higher risk of dropping out.

Methods. A descriptive analysis to compare the characteristics of students at high-risk and low- risk of dropping out of school has been performed. Focusing on the student classified in the high-risk group, we used a latent profile analysis (LPA) to examine the profile of these students in relation to seven measurements: demotivation, self-efficacy, parent's support, relationships with peers, future expectations, the score in Italian Language and the score in Math. To determine the optimal number of latent classes fitting the data, we examined the solutions containing no more than 3 clusters for different parameterizations of the covariance matrix and we compared all the models based on the fit statistics using the Bayesian Information Criterion. We used a multinomial regression model to evaluate the effect of the external covariates (ESCS, gender, immigrant status and the late-enrolled indicator) on the estimated class membership.

Results and Discussion. In this study we investigated the characteristics that accurately identify students more likely to drop out in the transition between the last year of the lower secondary school and the upper secondary school. The descriptive analysis of the characteristics of the high-risk group and low-risk group confirms the impact of dropout risk factors related to socio-demographic characteristics. Using a latent

model approach, we demonstrated the presence of three different high-risk students' profiles in terms of self-efficacy, demotivation, future expectations, relationship with parents and with peers and school performance. The findings of this work could be an important help to design effective dropout prevention programs based on an efficient and early identification of the student at-risk.

Giuseppina Le Rose, psychologist, psychotherapist and expert in psychological evaluation and counseling, currently works at INVALSI. She has performed numerous educational and vocational interventions and collaborated in the preparation of psycho-aptitudinal, cognitive and personality tests.

Chiara Sacco, PhD in Statistical Methodology for Scientific Research, currently works at the INVALSI Research Institute as statistician. The main research interests are in the context of multivariate data analysis for high dimensional data with particular focus on dimension reduction strategies, model based clustering and latent variable models.



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