

## Article

# The Development of Cognitive and Noncognitive Skills in Students in the Autonomous Province of Trento

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**Abstract:** The analysis of what human capital (HC) is has a long history and culminates in the acknowledgment that HC and its growth are very important for both cognitive education (cognitive skills (CSs)) and personal life (noncognitive skills (NCSs)) and that CSs and NCSs have a strong reciprocal relationship, as studies by Heckman demonstrated. The present contribution (following Heckman's approach) analyzed the relationship between CSs and NCSs in a sample of middle school students in the Autonomous Province of Trento. The second goal of the research was to verify whether educational teaching behaviors improved students' personalities. Aside from the use of administrative data (INVALSI data, 2015 and 2018), one survey was administered in the 2018–2019 schooling year to verify the relationship between NCSs and CSs. Moreover, we sought to determine whether education teaching behavior improved the students' personalities (1522 students in 25 schools) and whether programs could enhance NCSs. Methodological tools for the analysis involved the generalized least squares approach to answer the first question and a difference-in-differences model for the second. The main results showed that the levels of NCSs affected the ability to learn and improve CSs; a challenging teaching approach, especially if accompanied by programs improving its quality, had positive results. Finally, the research suggested that a wider, national-based survey following students from primary to secondary school would allow for a greater understanding of the dynamics of CSs and NCSs.

**Keywords:** human capital; character skills; cognitive skills; education



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## 1. Introduction

The endeavor to define human capital (HC) and how it can be measured has a long history. One particularly appropriate definition of HC aimed to measure its contribution to production value, determining the costs of its loss (due to, for example, war casualties (Petty 1690)) and understanding what creates remuneration differences in different occupations and professions (Smith 1776).

However, the ensuing debate strongly questioned whether one should even speak of “human capital” since this term reduced the worker, i.e., the individual, to an economic “object”. Adam Smith did not use the term and referred instead to the skills of individuals, highlighting that these can be described in terms of various components. Similarly, Mill (1848) believed that a human being cannot be defined as capital, and Marshall (1890) referred to the personal wealth of an individual's faculties, energy, and behaviors, where these are the characteristics that should be considered when assessing a person's value. This position, which distinguished between the value of human beings and their characteristics, liberated the concept of human capital from the ethical problems mentioned above.

Therefore, the term “human capital” (HC) has continued to be used, both because of its importance and in order to understand how these elements can be enhanced (Acemoglu and Angrist 1999).

In the following section, we provide a brief overview of how the definition of human capital and its measurement have evolved.

From the outset, the literature identified two main methods with which human capital can be measured (UNECE 2016; Acemoglu and Autor 2011): the “cost-based approach” and the “lifetime income approach”.

The latter measures human capital by summing the discounted values of all future income streams that any individual in the population expects to earn throughout their lifetime (see, e.g., Weisbrod 1961; Graham and Webb 1979; Jorgenson and Fraumeni 1989). This approach, which defines the net present value of HC as the sum of all future benefits, would appear to be the most appropriate one. Its measurement, however, requires assumptions about the future development of the (active) population and changes in labor markets, economic activities, and social life, which are not easy to forecast. It is also affected by the uncertainty regarding the appropriate discount rate. For this reason, a cost-based estimation is typically proposed instead.

The cost-based approach calculates human capital as the actual value of the stream of past investments—both monetary and nonmonetary—made by the individual, their family, employers, and public institutions (Schultz 1961). Becker (1962, 1964) emphasized that the dimensions of the investment in human capital include educational aspects at both the family and school levels, on-the-job technical training, health, and education in social behavior. However, the fact that human capital has diverse dimensions with distinct characteristics, the skills learned are either general or linked to specific techniques (which are open to innovation changes and are, therefore, uncertain), and the need to define the appropriate interest rate all lead to difficult questions.

This has led to the adoption of the “indicator-based approach” in the measurement of HC. This method measures the investment made using indicators related to the level of education and training, health, psychological, and other factors, which is maintained as a vector of explanatory variables. The simple connection with educational aspects does not seem sufficient. Acemoglu and Angrist point out that many education indicators often do not consider the quality of the education itself, which may vary greatly.

At this point, the problem of measuring human capital becomes the definition and measurement of a vector of dimensions that are often interrelated, which comprise, in particular, personality traits as the decisive factor. In the literature, due to James Heckman’s school, these dimensions were identified as noncognitive skills (NCSs), which are associated with other indicators specifically related to cognitive skills (CSs), particularly scholastic ones. These are malleable, often interconnected (particularly the various NCSs) characteristics that evolve throughout someone’s life.

After a description of Heckman’s approach, the following analysis examines the dynamics of the interaction between NCSs and CSs through a survey with a sample of 1522 middle school students of the Autonomous Province of Trento in the 2018–2019 school year.

## 2. Previous Empirical Studies: Some Milestones

As was mentioned in the introduction, James Heckman and his school (Cunha et al. 2006; Heckman et al. 2006; Cunha and Heckman 2007, 2008; Cunha et al. 2010) were the first to recognize the importance of NCSs and quantitatively measure their effects on a wide variety of outcomes, from a child’s success in their educational journey and social and economic dimensions to a person’s physical and mental health as an adult. Two particular studies within the American context are particularly relevant from a methodological perspective.

In the first (Cunha et al. 2006), Heckman et al. indicated that CSs and NCSs are equal determinants of success in several dimensions of life, such as education, level of income, employment, and risk behaviors in adolescents<sup>1</sup>.

The second study (Cunha et al. 2010) examined how much the CSs and NCSs possessed by the child, the investment in human capital, and parents' CSs and NCSs influenced the child's ultimate skill level<sup>2</sup>. The findings emphasized that if a school pathway only focuses on CSs, it cannot overcome previous inequalities, whether familial or social.

There are important methodological innovations that were introduced by Heckman and other scholars collaborating with him:

(a) The authors used both static and dynamic factorial model systems, where CSs and NCSs were defined as the unobservable traits of individuals that generated the observed outcomes (e.g., learning and behavioral test scores, school grades, academic achievement, wage level, and career performance). In line with the OECD definition, they are derived as multidimensional constructs that are not directly measurable but obtainable, barring errors, from an appropriate set of observable attributes.

(b) It is made explicit that the relationship between NCSs and CSs and the observable outcomes is not only empirical but causal. NCSs and CSs "generate" the observed outcomes mentioned above.

(c) NCSs and CSs, measured at different times during the participants' lives, are included in equations as both explanatory and dependent variables. It is thus possible to analyze, from a longitudinal perspective, how much NCSs influence CSs and how much CSs influence NCSs at different moments. It is also possible to test how these competencies are interrelated with the other characteristics of children, families, school, work, and social contexts in numerous scenarios and outcomes.

(d) The databases on which Heckman's studies are based are extremely rich and of high quality. Although the NLSY79 (National Longitudinal Survey of Youth)<sup>3</sup> consists of sample data, it is almost comparable to an administrative database in terms of sample size and representation. The NLSY79's (CNLSY79) section on children contains longitudinal data of the biological children of the mothers questioned in the NLSY79 survey. The CSs collected in the database consist of mathematical abilities (arithmetic reasoning test scores, numerical operation test scores, and mathematical knowledge test scores), language proficiency (word knowledge test scores, paragraph composition test scores, and coding speed test scores), and general aspects, such as the Armed Services Vocational Aptitude Battery. There are also indicators of the family context. Regarding NCS indicators, Heckman et al. (2006) were only able to use two for each research study because these measurements were the only ones in the NLSY79 sample: the Rosenberg Self-Esteem Scale and the Rotter Locus of Control Scale for 2006 and the Temperament Scale and the Behavior Problems Index for 2010.

(e) Particular attention is paid to the analysis of possible problems of endogeneity, while there are no problems with the self-selection of individuals since the sample was collected nationally and thus represents the entire population.

Building on the methodologies developed in the works analyzed, the OECD promotes international empirical research in several of its member countries. The 2015 OECD report (OECD 2015) emphasizes the role of NCSs in conjunction with CSs as key success factors in several dimensions of life, highlighting how mutually reinforcing they are. Conscientiousness, agreeableness, and emotional stability are the NCSs that most determine individuals' success and increase their ability to pursue and achieve goals, work with others, and manage emotions and reactions.

The 2017 OECD (OECD 2017) report offers a comprehensive picture of the different dimensions of personhood. It refers to the Programme for the International Assessment of Adult Competencies, which relates to the assessment of the competencies of the adult population between the ages of 16 and 65 years. The report also presents the most important tools for the measurement of each trait, with particular attention paid to the short-version questionnaires for the self-assessment of competencies.

International research has aimed to determine whether appropriate educational projects that are designed and executed by schools as part of their curriculum can improve NCSs. These include Big Brothers Big Sisters (Tierney et al. 2000), IHAD (Kahne

and Bailey 1999), EPIS (Kahne and Bailey 1999), XL Club (Holmlund and Silva 2014), and Programa de Acompañamiento Escolar (PAE) (García-Pérez and Hidalgo-Hidalgo 2017).

For the most part, the samples consisted of students from the fifth to the eighth grade (the analog of the Italian middle school), or students in the subsequent two years (the first two years of high school in Italy) who were enrolled in support activities (tutoring; personalized school treatment; family dialogs; common afternoon activities, such as studying and living together; etc.). These students were more vulnerable than their peers, both socially (children of migrants or from single-parent families) and in terms of their schooling (low academic performance).

In general, it was observed that the activities of tutoring and accompaniment, in many instances, decreased drug or alcohol addiction (see, e.g., the project Big Brothers Big Sisters). In contrast, there was much less improvement in self-concept and academic achievement, especially for those students who came from more dire family and social circumstances. The case of the PAE in Spain stands out; it is based on training and tutoring conducted in the afternoon for students who are behind in their studies. This project has led to consistent educational improvement when continued for at least two/three years. To complete the empirical analyses of the links between NCSs and cognitive ability, we mention the contribution of Checchi and De Paola regarding the effects of educational activities with multigrade students (classes in Italian schools where the students are at different levels of study) (Checchi and De Paola 2018). The data revealed that students who are placed in classes where their peers are at the same level of study (fifth grade) have an advantage in terms of CSs and NCSs compared with students in multigrade classes.

### 3. The Link between NCSs and CSs: The Case of the Autonomous Province of Trento

Compared with the complexity and richness of Heckman's models, the research on middle school students in the Autonomous Province of Trento represents only a first step because the field is strictly school-based and inherent only to elementary and middle schools. We aimed to answer the following research questions:

- Are NCSs related to academic outcomes? In other words, does the level and development of NCSs also promote development in CSs?
- Is it possible to implement programs and activities aimed at improving NCSs throughout the course of schooling? Can NCSs be developed through educational interventions in school settings?

To respond in a methodologically adequate manner, the following choices were made:

(a) The identification of an area in which the level of skills and knowledge is high; that is, we identified an area in which there were no serious socioeconomic problems and in which paying attention to NCSs was already an established practice. In this way, the analysis of the relationship between NCSs and CSs was not affected by disruptive factors and educational interventions to improve NCSs could be observed. Hence, we chose to conduct the research with a sample of elementary and middle school students in the Autonomous Province of Trento, which is one of the Italian provinces with the best scores in the Progress on International Reading Literacy Study (Martin and Mullis 2013).

(b) Great accuracy in the definition of the variables that described CSs and NCSs, particularly in terms of the following:

- The measurement of CSs through standardized tests that were uniformly evaluated at the national level to avoid bias due to teachers' subjective evaluations.
- The assessment of NCSs was not undertaken with a single indicator but instead respecting the multidimensional nature of personality traits through a set of psychological constructs based on solid theoretical foundations (see Table A1).

(c) The verification of the effect of the NCSs was not based on the absolute value of CSs but rather the increase in value, which is in line with the educational theory of added value<sup>4</sup>.

(d) The verification of the non-self-selection of the sample since, for ethical reasons, it was not possible to build a randomized sample of minor age students without their consent. Therefore, we verified the absence of self-selection in the sample.

(e) Regarding the evaluation of the effects of educational programs on increasing NCSs, we conducted:

- A comparison of NCSs before and after the educational interventions that were designed by schools to improve them.
- The administration of structured educational interventions on non-disadvantaged children to avoid the limitations of many of the previous studies that were also based on disadvantaged students.
- The use of models that assess the effects of educational interventions.

#### 4. Data

##### 4.1. The May–June 2018 Survey

To obtain reliable data, an integrated dataset was constructed:

(a) From the 2015 and 2018 INVALSI<sup>5</sup> administrative datasets, we obtained the test results of middle school students in Italian language and mathematics. From the 2015 dataset, we also derived data relevant to several NCS dimensions.

(b) Through a survey conducted from May to June 2018, with the schools' collaboration, we identified the NCSs of students in their third year of middle school (2017–2018). The schools' participation in the project was free, and 25 schools agreed to participate; 1522 students from 109 different classes (out of a total of 5502 students) sufficiently completed the questionnaires. The students in these schools were given a questionnaire to gather information and estimate the various NCS dimensions. These NCSs, while defined by a different name, were consistent with the 2015 INVALSI NCSs.

(c) The students in our sample had normal schooling conditions; we did not focus on students in precarious conditions or poverty to avoid the biases mentioned above regarding the link between NCSs and CSs and the effects of educational projects on NCSs.

(d) Data on the students' family and social contexts were obtained from the data warehouse of the Department of Knowledge of the Autonomous Province of Trento<sup>6</sup>. This information was included in the model as control variables.

Therefore, the overall dataset was constructed by matching these sources and using anonymized codes to track information from different sources on the same student while respecting their privacy. The list of all the variables collected is reported in Table A2. Table A3 compares the NCSs measured by the INVALSI questionnaire of 2015 with those measured by the May 2018 survey, which was paired with the analysis.

The research team verified whether the relevant schools' decision to participate in the project was random or instead due to a particular characteristic of the students or schools. In fact, given the voluntary nature of participation in the research, it was necessary to test the representation of the sample of students in the Autonomous Province of Trento; that is, they were not characterized by higher/lower cognitive skills or better/worse socioeconomic status than the students of the schools that did not participate. In fact, this self-selection could have created a statistical bias, invalidating the results.

Tests on the randomness of the sample revealed that the participating schools did not have different characteristics, particularly regarding the students' cognitive knowledge (Table A4). Moreover, the same test conducted on the ESCS indicator regarding socioeconomic circumstances did not show differences (Table A5); thus, it could be concluded that voluntary participation in the project did not result in selection bias.

##### 4.2. Educational NCSs Programs

In addition to the student survey, through an interview with the educational supervisor of each school, we found, in several schools and classes, the presence of structured educational activities on the themes of citizenship, legality, and respect for the environment, i.e., educational activities related to the development of noncognitive skills.

Starting from 2015 up to 2018, the PAT elaborated plans focused on student learning and improvements to the NCSs involving teachers, active teaching methodologies, information orientation, training, and counseling for all schools. The schools' choice to participate or not was made before the enrollment of a cohort of students who must complete a three-year course in middle school. In this way, it was not influenced by parental pressure but was only decided by the school administrators. Once a school chose to participate, all students compulsorily participated in the same activities with the same time commitment that varied between projects. A total of 108 programs that aimed to enhance NCSs, which varied in scope, were identified.

According to this view, the participating schools could be divided into two groups: one group of 12 schools (with 828 students in 61 classrooms) that ran substantial projects for the development of NCSs and another group of 13 schools (with 694 students in 48 classrooms) that did not. The students in classes in which these activities were conducted comprised the "treatment group", while the students in the classes in which the activities were not conducted comprised the "control group".

### 5. The Methodology: Factor Analysis, GLS, and Difference in Differences

As suggested by the relevant literature, the NCSs are derived from the observed responses to the questionnaires using confirmatory factor analysis (CFA). Factor analysis is a statistical method that expresses these observed responses as linear combinations of a number of unobserved variables (or latent traits), called factors, plus "error" terms. Therefore, each NCS is a factor that underlines and "causes" its correspondent observed answers to the questionnaire. Confirmatory factor analysis (CFA) adds some a priori hypotheses regarding the kinds of links between the responses to the questionnaires and the corresponding NCS factors (Jöreskog 1983).

At this point, to answer the first research question regarding the influence of NCSs on CSs, a generalized least squares (GLS) model<sup>7</sup> was used. A first specification had the INVALSI grade in mathematics as a dependent variable, while a second specification of the INVALSI score had Italian as a dependent variable, which were both from the end of the eighth grade in 2018.

$$(a) CS_{i1} = a + bNCS_{it} + dCS_{i0} + fZ_i + e_i \quad (i = 1, \dots, n)$$

where

$CS_{i1}$ —INVALSI scores in mathematics (or Italian) of student  $i$  at the end of the eighth grade in 2018.

$NCS_{it}$ —The vector of the NCS of student  $i$  in the fifth grade (2015) and eighth grade in 2018.

$CS_{i0}$ —The vector of the INVALSI scores in mathematics and Italian of student  $i$  at the end of the fifth grade in 2015.

$Z_i$ —The vector of control variables (demographic, socioeconomic, etc.) related to student  $i$ .

$e_i$ —The error related to student  $i$  that was assumed to have zero mean and a normal distribution.

The difference-in-differences approach (Lechner 2010) allowed us to test whether educational programs had a causal effect on the NCS development.

"Difference in differences (DID) is a statistical technique used in econometrics and quantitative research in the social sciences that attempts to mimic an experimental research design using observational study data, by studying the differential effect of a treatment on a 'treatment group' versus a 'control group' in a natural experiment. It calculates the effect of a treatment (i.e., an explanatory variable or an independent variable) on an outcome (i.e., a response variable or dependent variable) by comparing the average change over time in the outcome variable for the treatment group to the average change over time for the control group" (Angrist and Pischke 2008).

We compared the differences in NCSs between the two groups of students who were and were not offered educational programs to determine the net effect of the covariates.

Thus, it was possible to estimate the differential effect of change over time between the two groups:

$$(b) \text{NCS}_{it} = k + mT_i + pX_i + u_{it} \quad (i = 1, \dots, n)$$

where

$\text{NCS}_{it}$ —The NCS of student  $i$  at time  $t$ .

$T_i$ —Educational program: a dummy variable with a value of 0 for students in classes with no educational programs and a value of 1 for students in classes where these programs were implemented.

$X_i$ —The vector of covariates related to student  $i$ .

The model assumed that these covariates were time-invariant.

$u_{it}$ —The error related to student  $i$  at time  $t$  that was assumed to have a zero mean and a normal distribution.

Regarding the survey considering educational projects (December 2018), approximately 108 educational projects were implemented in the schools; they could be categorized as follows:

- Critical awareness: the first type aimed to stimulate students' ability to make decisions, helping them to think critically.
- The development of knowledge and awareness: the second type aimed to inform students of their choices and reasons.
- Didactics and school environment: the third type focused on NCSs related to the school environment. These programs aimed to create an environment that facilitated relationships, dialog, and learning and contributed to the advancement of the community of teachers and students.

The first two types were aimed primarily at NCSs, which are more related to the characteristics of students, while the third was more related to instructional aspects.

The effectiveness of the educational treatment was evaluated in terms of several noncognitive competencies:

- Big Three: relational stability (extraversion and agreeableness), inner stability (openness to experience and conscientiousness), and emotional stability.
- Psychological capital<sup>8</sup>: optimism and self-efficacy.
- Motivation and learning goals: learning orientation, performance orientation, school motivation, and external regulation.
- Social capital: the quality of teaching (challenge, management), extracurricular activities (watching television; playing computer/video games; playing with friends; reading a book; doing homework; helping out around the house; playing sports; and other activities, such as theater, music classes, and language classes), and the ESCS family socioeconomic indicator.<sup>9</sup>

The variables of the synthetic Big Three version and those of psychological capital identify students' specific character traits. The other dimensions, such as individual learning goals, school motivation, and external regulation, identify factors that are more closely related to the students' educational backgrounds and how they experience them.

The following variables are the ones considered covariates in the model:

- CS: INVALSI Italian and mathematics in 2015 for the fifth grade and in 2018 for the eighth grade.
- Control variables: gender, at least one Italian parent, a school located in the urbanized Adige Valley vs. a school in a mountain valley, full-time vs. half-time enrolment, the type of high school the student intends to choose, and preschool enrolment.

## 6. Results

### 6.1. The Impact of NCSs on CSs

This section presents the results obtained from the analysis of the relationship between eighth graders' CSs (first survey, May 2018) and their NCSs. The dependent variables, measuring the CSs, were the grades of the 2018 INVALSI tests for Italian and mathematics.

First of all, when conducting an observational study, we have to exclude any self-selection, both regarding the schools participating and not participating in the survey and regarding the schools participating and not participating in the educational NCS programs. Regarding the participation in the survey, we compared the average achievement scores in Italian and mathematics of the participating and nonparticipating schools to verify whether both groups had the same level of cognitive skills. The *t*-tests shown in Table A4 did not reject the hypothesis that the average scores in Italian and mathematics of the eighth-grade students were equal. Therefore, there was no self-selection between better and worse schools that participated in the survey.

Moreover, with respect to the possibility that NCSs influence CSs and not vice versa, as shown in the analysis, we note that, both at the beginning of the analysis (5th grade) and at the end (8th grade), the NCS are detected during the school year and therefore before the CS that are detected at the end of the year.

Given that, the results (obtained with the GLS model) are reported in Table A6. The R2 of the two models (0.55, 0.56) indicated that the chosen variables explained the results of the INVALSI 2018 tests satisfactorily.

Considering a minimum significance level of  $p = 0.01$ , the following was observed with the individual variables:

(a) The first evidence concerned the link between NCSs and CSs. Inner stability (the synthesis of conscientiousness and open-mindedness) and emotional stability were positive and related to the INVALSI 2018 results in Italian and mathematics.

In the same vein, positive self-assessment (self-concept) had a positive link with the 2018 INVALSI results in mathematics. In contrast, being dependent on the judgment of others (external regulation) had a negative link with the 2018 INVALSI results in Italian and mathematics. Experiencing anxiety during the 2015 INVALSI test (as opposed to emotional stability) had a negative link with the 2018 INVALSI results in Italian. Overall, CSs were higher when NCSs, which denote greater student maturity, were more relevant, while NCSs that denote fragility were empirically related to worse CS results.

(b) The following evidence was related to the type of teaching. In particular, teaching that "challenged" students to learn (challenging teaching), and thus stimulated the development of NCS, had a positive relationship with the INVALSI 2018 tests in Italian. This result was confirmed by the fact that "learning orientation" also had a positive relationship with the 2018 INVALSI Italian tests, while a more traditional teaching approach that was not focused on developing NCSs (management teaching) was negatively linked with both 2018 INVALSI tests. Similarly, the quality of relationships in the classroom in 2015, which was also related to the development of NCSs, was positively linked to the 2018 INVALSI Italian test.

(c) Regarding social capital dimensions, the variables related to the increase in NCSs, such as reading books, doing homework, and studying languages or music, were positively related to the results of the 2018 INVALSI tests in Italian and mathematics. Other activities not directly related to studying, such as playing with friends or helping around the house, had a negative relationship with the 2018 INVALSI tests.

(d) The research also indicated that the 2018 INVALSI test scores in the eighth grade in both Italian and mathematics were positively correlated with the corresponding tests obtained by students in the fifth grade in 2015. This highlighted how primary education is crucial to the acquisition of CSs at the end of middle school, with evident added value, as it is emphasized in all the relevant literature (Heckman et al. 2014).

(e) Variables regarding preschool, the choice of full-time education at school, and the prospect of embarking on a challenging educational path in the future (high school



vs. technical institute) appeared to be positively related to the 2018 INVALSI results. In different ways, these variables describe a decisive and important investment in the school path. In particular, the fact of having attended preschool leads to a positive link to the 2018 INVALSI results in mathematics and demonstrates the significance of the early years of life for learning, as all the literature suggests (Heckman et al. 2014).

Full-time schooling, which encourages children to live together, positively affected NCS development and CS acquisition. On the other hand, it was necessary to verify a possible endogeneity in the link between the choice of one's future school and academic results because if it is true that those who want to continue with high school have the best results, this may not exclude the fact that the best students are those who continue with high school.

(f) With regard to socioeconomic aspects, the ESCS index (related to a higher level of education and socioeconomic status of the parents) and the ICEF<sup>10</sup> index (related to income) were positively connected with student outcomes, demonstrating that initial inequalities were not entirely overcome by the education system in the Autonomous Province of Trento.

(g) Finally, being a male student had a positive relationship with the INVALSI test in mathematics.

## 6.2. Results of DID

Regarding the participation of schools in the educational NCS program, there was no self-selection for two reasons. First of all, as said in Section 4.2, the schools decided to participate before the beginning of the year; therefore, the parents could not influence the decision. Second, as we show in Table A7, for each NCS variable, the *t*-tests did not reject the hypothesis that the initial average NCS scores (NCSs before the "treatment") of schools participating and not participating in the educational programs were equal.

The main research question regarding whether educational interventions designed to improve NCSs had a positive demonstrated effect indicated positive results for three of the NCSs: optimism, relational stability, and emotional stability, which were the NCSs that were most closely related to the students' personal characteristics. These results were consistent with what we saw in the GLS model.

Given the tripartition of the educational programs mentioned earlier, those that were shown to be most effective were those that intended to make students aware of their choices and reasons and support the full development of their character.

Challenging teaching had a positive effect on some NCSs, with no difference between students who received those educational programs and those who did not.

These results indicated that a teaching approach that is attentive to the creativity of children facilitates their desire to learn (see Table A8). Regarding the social capital variables, activities related to knowledge acquisition, such as completing homework and reading books, often had a positive effect on NCSs. In contrast, other aspects of social capital less closely related to knowledge (playing with friends) had a negative relationship with NCSs. The additional variables of extracurricular activities (watching television or taking a language course) had different effects depending on whether the dispersive or cognitive aspect prevailed.

In some cases, the results of the INVALSI tests in the fifth grade, which measure the initial level of knowledge, had positive effects on emotional stability, demonstrating the positive consequences on emotional state due to good school performance in primary schools.

Better social and socioeconomic status, as measured by the ESCS index, had positive effects on NCSs, as they are linked to optimism about the future.

Attending schools in urban centers (Adige Valley), where it was reasonable to expect more consistent "pedagogical competition" between schools and classrooms, increased the tendency to study for results.

Full-time schooling negatively affected relational stability, while having one parent of Italian nationality had a positive effect. Presumably, this meant that families with more stable and favorable living conditions could provide care for the child during the

day, thus deciding not to send the child to school full time, which had positive effects on relational stability. The prospect of embarking on a challenging school path in the future (high school vs. technical institute) was positively related to the growth of some NCSs (optimism, learning orientation, and autonomy). This choice indicated a willingness to invest decisively in one's human capital and, therefore, helped to develop the child's personality over time. However, in this case, there was also a possible endogeneity that must be verified because it could be likely that the positivity and clarity of intentions determined the choice of high school.

Finally, not having gone to preschool was negatively related to self-efficacy; this was likely because the positive effects of the social and educational stimuli of preschool were absent.

## 7. Conclusions

First, our results confirm the analytical approach introduced by Heckman, which indicated the links between NCSs and CSs. Second, the survey indicated that it was possible to improve some NCSs through educational programs in schools.

Our work created further opportunities for research on NCSs. It would be important to build a database (panel data) covering the entire school career of students from elementary school to university. In this way, the research could be developed in longitudinal terms, deepening the links between NCSs and CSs throughout the school and university pathway.

In an even more comprehensive manner, based on Heckman's 2006 study (Heckman et al. 2006), it would be possible to verify not only the connection between NCSs and CSs in the academic pathway but also the further effects on working experience and instances of high-risk behavior, crime, and social deviance.

However, the availability of data is fundamental to this. Privacy issues, the nonhomogeneity of public and private surveys, and different sources of information make it extremely difficult to build an integrated dataset, which is necessary to perform this type of analysis.

Such research can also create new scenarios for schools' education policies, educational authorities in charge of quality assessment, and national educational policies.

The ability to consistently assess the links between NCSs and CSs may foster new approaches to education that are less performance-oriented and more learning-oriented and that are more focused on fostering creativity, engagement, and student participation in the classroom and their educational process. Teachers and schools that are more attached to traditional teaching methods can be assisted with an alternative that is more stimulating for students.

This entails greater creativity, strong teamwork, accuracy, and vibrant and lively discussions of concepts rather than the simple repetition and mere memorization of concepts. Teachers and schools that have already understood the significance of NCSs for acquiring knowledge can be supported with technological and logistical solutions and organizational innovation that can improve teaching methods. A further policy suggestion arises from the fact that the research confirmed Heckman's conclusion (Heckman et al. 2014) that improvements in NCSs resulting from appropriate educational programs could be measured. By acquiring information on the link between NCSs, CSs, and the structural aspects of colleges and universities, suggestions could be made about policies to help schools to organize specific training activities to develop students' NCSs and measure the effects of such activities.

The fact that Heckman himself refers to NCSs as character skills suggests that the most decisive policy is to strengthen the educational capacity of teachers and their ability to work with the overall personality of the children to stimulate their passion for learning and interacting with the teachers, not only at the educational level but also the human level.

If factors related to the structural and permanent characteristics of schools and universities (such as laboratories, buildings, and digital tools) are determinants in the transformation of NCSs into CSs, long-term investments are necessary to make the above-mentioned

changes. If short-term elements (such as the quality of administrative or teaching staff and organizational aspects) appear more important, the appropriate selection and training of those working in educational areas will be fundamental to improving the education on offer.

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## Appendix A

**Table A1.** Psychological constructs and latent variables.

Psychological Construct	Latent Variables
Big five	Openness Conscientiousness Extraversion Agreeableness Emotional stability
Psychological capital	Hope Resilience Optimism Self-efficacy
Self-regulation of the motivation to study	External regulation Identified regulation Introjected regulation Intrinsic regulation
Assessment of learning goals	Mastery goal orientation Performance approach
Effective teaching evaluation	Care Confer Captivate Clarify Challenge Management

**Table A2.** Variables.

CS Variables 2015 and 2018	NCS Survey Variables 2018	Social Capital 2015 and 2018
Evaluation regarding the admission to middle school final exam	Inner stability	Watching television, DVD
Score of the middle school final test	Relational stability	Using computer, playing videogames
INVALSI 2015 Italian and math	Emotional stability	Playing with friends
INVALSI 2018 Italian and math	Learning-oriented	Helping at home
<b>NCS INVALSI Variables 2015</b>	Performance-oriented	Reading a book
Caused bullying	Motivation	Doing homework
Suffered bullying	External regulation	Playing sports
Anxiety during INVALSI tests	Self-efficacy	Music, theater, language courses
Italian self-concept	Optimism	Challenge
Math self-concept	<b>Control Variables</b>	Management
Performance-oriented	Gender	Italian parent
Learning-oriented	High school	Italian mother
Support for studying	Full time	ESCS
Class relationships	Adige Valley	ICEF
Well-being	Kindergarten	

**Table A3.** Comparison between the INVALSI 2015 and PAT 2018 NCS variables.

INVALSI 2015	PAT 2018 NCS
Well-being at school 2015	Optimism
Italian self-concept, math self-concept	Self-efficacy
Quality of class relationships 2015	Relational stability
Learning-oriented 2015	Learning-oriented
Motivation 2015	Motivation
Performance-oriented 2015	Performance-oriented
(-) Anxiety during INVALSI test	Emotional stability
Caused bullying 2015, suffered bullying 2015	(-) Inner stability

**Table A4.** The *t*-test mean(0)–mean(1).

Group	Obs	Mean	Std. Dev.
INVALSI math 2018			
0	52	214.791	8.6055
1	25	217.1776	7.5085
<b>Difference</b>		−2.3686	14.942
<b>Diff: mean(0)–mean(1): <math>t = -1.244</math>; g.d.l. 60.2; <math>\Pr( T  &gt;  t ) = 0.11041</math></b>			
INVALSI Italian 2018			
0	52	208.4684	7.1991
1	25	210.5079	6.6226
<b>Difference</b>		−2.0395	12.333
<b>Diff: mean(0)–mean(1): <math>t = -1.229</math>; g.d.l. 54.7; <math>\Pr( T  &gt;  t ) = 0.11053</math></b>			

**Table A5.** The *t*-test mean(0)–mean(1), ESCS.

Group	Obs	Mean	Std. Dev.
0	33	0.0785926	0.0032049
1	25	0.0734703	−1,658,674
<b>Difference</b>		<b>0.0051223</b>	
<b>Diff: Mean(0)–Mean(1): t = 0.9816; g.d.l.: 4112; Pr( T  &gt;  t ) = 0.3263</b>			

**Table A6.** Results of the GLS model, May 2018.

Variables	INVALSI Italian 2018 Grade	INVALSI Math 2018 Grade
INVALSI Italian 2015	0.340 ***	0.114 ***
INVALSI math 2015	0.157 ***	0.457 ***
Inner stability	12.10 ***	10.49 ***
Emotional stability	3.452 ***	2.109 **
Learning orientation 2015	2.924 *	
Performance orientation 2015	−2.122 **	
Regolazione esterna	−4.860 ***	
Playing with friends		−2.112 ***
Helping at home	−3.380 ***	−2.528 ***
Reading a book	2.945 ***	0.0368
Doing homework	2.038 **	2.654 ***
Music, theater, . . .		1.368 *
Challenge	3.929 **	
Management	−2.546 *	−2.963 *
ICEF	2.261 *	0.0985
ESCS	1.746 **	2.050 ***
Performance-oriented 2015	−2.027 **	
Learning-oriented 2015		−4.221 **
Math self-concept 2015		3.139 ***
Quality of class relationships 2015	2.256 *	
Anxiety during INVALSI 2015	−1.660 *	
Gender		4.855 ***
High school	4.155 ***	4.606 ***
Full time	3.466 **	5.147 ***
Kindergarten		6.339 ***
Obs	1521	1521
Number of schools	25	25
R <sup>2</sup>	0.5498	0.5652
Wald c <sup>2</sup>	1806.48	1922.29
	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .



Table A8. Cont.

Variables	Optimism	Self-Efficacy	Relational Stability	External Regulation	Learning Orientation	Support for Studying	Performance Orientation	Emotional Stability	Stabilità Interiore
Doing homework					0.084 **	0.255 ***			0.072 *
					−0.034	−0.093			−0.04
Theater, music, and language courses					−0.062 *				
					−0.037				
Italian parent			0.341 **						
			−0.139						
ESCS	0.108 **								
	−0.047								
High school	0.189 **				0.174 **	0.314 **			
	−0.085				−0.083	−0.146			
Kindergarten		−0.242 **							
		−0.093							
Full time			−0.116 *						
			−0.06						
Adige Valley				0.090 **			0.078 **		
				−0.04			−0.038		
Constant							1.790 ***		
							−0.498		
Obs	1521	1521	1521	1521	1521	1521	1521	1521	1521
R-squared	0.364	0.325	0.228	0.141	0.269	0.476	0.181	0.253	0.259
Robust standard errors in parentheses	*** $p < 0.01$ , ** $p < 0.05$ , * $p < 0.1$								

## Notes

- The model used is a static factorial model with endogenous factor loadings.
- The model used is a nonlinear dynamic factorial model.
- National Longitudinal Survey of Youth (NLSY79), (U.S. Bureau of Labor Statistics n.d.), <https://nlsinfo.org/content/cohorts/nlsy79> (accessed on 11 June 2018); NLSY79 Child and Young Adult Data Overview, (U.S. Bureau of Labor Statistics n.d.), <https://www.bls.gov/nls/nlsy79-children.htm> (accessed on 11 June 2018). The construction of the database is part of a program of the U.S. National Bureau of Labor Statistics; it refers to a sample collected on a national basis, considered representative of the population of the United States between the ages of 14 and 21 on 31 December 1978. In 1986, the separate survey involving all children of the respondents was initiated and is administered every two years. The purpose is to obtain information on cognitive ability, character, motor development and social-relational development and the quality of the family environment. The database contains a great deal of information regarding the employment, education, training, and family background of the respondents.
- See: *Special issue*, in «*Journal of Educational and Behavioural Statistics*», 2004; *Special issue*, in «*Journal of Education, Finance and Policy*», 2009.
- INVALSI (Istituto nazionale per la valutazione del sistema educativo di istruzione e di formazione) is the Italian National Institute for the Evaluation of the Education System. INVALSI was established to evaluate the level of competence achieved by students during their years in full-time education, as well as the role of schools in determining those results. INVALSI developed standardized tests to assess students at various stages in their education, which have been used since 2007/2008. The new evaluation system was almost fully implemented by 2011/2012, with the tests being set at the end of the second and fifth years of primary school, at the end of the first and third years of middle school, and at the end of the second year of high school.
- Additionally, in this case, the methodology of data linkage was implemented to respect the anonymity of the information to comply with privacy regulations.
- GLS allows for any heteroschedasticity and correlation between errors. See W.H. Greene, *Econometric Analysis*, Upper Saddle River, Prentice-Hall, 2000.

- <sup>8</sup> With respect to the classic four dimensions with which psychological capital is described, the two dimensions of hope and resilience were not on the list, as they were not used in the regression analysis because they were poorly correlated with the dependent variables in the various models.
- <sup>9</sup> *Economic Social and Cultural Status*; the index is made up of three subindices related to family conditions: employment status, educational level, and economic conditions. OECD, *Skills for Social Progress*, cit.
- <sup>10</sup> The ICEF indicator (indicator of family economic condition) is a set of personal, income, and asset data that allows for access to provincial benefits through the measurement of the economic condition of a family unit. Introduced by art. 6 of Provincial Law n.3 of the Autonomous Province of Trento. Over the years, it has become the sole indicator for the application of welfare services provided by provincial and municipal bodies, replacing in almost all cases the ISEE indicator (still used at the national level). Source: <https://www.cislservizitn.com/icef/> (accessed on 15 September 2018).

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