

Effect of school management improvements on the student's social and emotional skills: Experimental evidence from Brazil

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ABSTRACT

This paper investigates whether changes in school management practices affect the development of social and emotional skills among high-school students. Social and emotional skills have become increasingly important in the labor market, and school management is a key factor that can contribute to the development of these skills. The study presents the findings of a randomized field experiment conducted in 2015 in Brazil with 290 public schools and approximately 52,000 students, focusing on five social and emotional skills: self-management, open-mindedness, emotional stability, amity, and engaging with others. The treated schools participated in a program that combined classroom observation feedback and specialized training to improve the effectiveness of high school teachers in the classroom. The results suggest that improvements in school management have a positive impact on self-management and open-mindedness skills. We also found the presence of heterogeneous effects, especially for students with low socioeconomic status. The study also explores the mechanisms underlying these findings, showing that changes in teachers' practices as a result of participation in the school management program were relevant to the program's impact on social and emotional skills. This paper contributes to the literature on the importance of school management practices for developing countries and the broader effects of such programs on social and emotional skills.

Key words: School management, social and emotional skills, teacher practices in the classroom

JEL classification: I20; I24; I29

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1 Introduction

School management is an important factor in the educational process, especially for public education. Several recent studies have consistently documented that improving school management impacts on learning (Bruns et al., 2018; De Hoyos et al., 2017; Fryer et al., 2017; Romero et al., 2020)¹. School management programs are highly cost-effective because they target school leaders, which implies that learning gains are spread throughout the school. Comparing developed and developing countries, there is still a significant gap in terms of the quality of school management (Leaver et al., 2019; Bloom et al., 2015), suggesting that this factor provides a policy opportunity for developing countries. Despite the impact of improving school management on learning, there is scant evidence on the effect of school management quality on other types of higher-order (or complex) skills, such as social and emotional abilities.

Social and emotional skills are defined as the individual capacities that are manifested in consistent patterns of thoughts, feelings, and behaviors, that can be developed through formal and informal learning experiences, and that influence important socio-economic outcomes throughout the individual's life, like educational attainment, wages, job performance, and health outcomes (OECD, 2017). Recent evidence documents rising returns of non-cognitive skills in comparison with cognitive skills in the 2000s (Edin et al., 2017; Deming, 2017, 2021), highlighting the growing importance of these skills for the labor market². Many interventions have been designed to foster students' social and emotional skills (Algan et al., 2022; Sorrenti et al., 2020; Alan et al., 2019). However, these skills can also be learned through informal experiences related to school, family, and peers (Cunha et al., 2010). Improvements in the quality of school management can potentially also impact on social and emotional skills.

This paper investigates empirically whether changes in the quality of school management may affect five social and emotional skills: self-management³, open-mindedness, regulation of negative emotions (also

¹A recent meta-analysis focused on school management programs in low and middle-income countries found an average impact of $0.033s.d$ in learning (Anand et al., 2023). In Brazil, the focus of this paper, Leaver et al. (2019) and Bruns et al. (2018) found a similar impact of school management on math learning using different empirical strategies. They document an effect size in low-stakes test scores ranging from $0.02s.d$ to $0.07s.d$.

²In part, the rise in the return of non-cognitive skills is related to the introduction of new technologies that make it possible to substitute "routine" tasks with "non-routine" analytical tasks and that require higher non-cognitive skills. This process has raised the demand for workers with high non-cognitive skills (Autor et al., 2003; Acemoglu and Autor, 2011).

³There are different names attributed to self-management skills. In classical personality trait theory, self-management is called conscientiousness. OECD (2017) named this skill task performance. We follow the terminology adopted by Senna's instrument, which we will use to measure it.

called Emotional Stability), amity, and engaging with others. We present the findings of a randomized field experiment conducted in 2015 in the state of Ceará, Brazil, with 290 public schools and approximately 52,000 students. The 155 schools that were treated received a program that combined classroom observation feedback and specialized training to improve high school teachers' classroom effectiveness. Each school's teaching coordinator received specialized coaching to improve their ability to support teachers in increasing classroom effectiveness. The program aims to promote "good" school management practices that are recommended by experts ([Adelman and Lemos, 2021](#); [Bloom et al., 2015](#)). Following the taxonomy of management practices developed by [Bloom et al. \(2015\)](#), the program attempted to enhance classroom monitoring and the skills of teachers and principals, with a focus on improving classroom effectiveness, which is related to operations and personnel management practices ⁴.

[Bruns et al. \(2018\)](#) also analyzed this field experiment to investigate the impact of school management programs on learning in math and language. They found that school management programs had a positive impact on both language and math in high and low-stakes standardized tests. In addition, the program also changes teachers' practices in the classroom. Specifically, teachers increased the use of class time for instruction, decreasing the time spent on classroom management and the time spent outside the classroom. In conclusion, the program was effective in improving school management in the treated schools and had the expected effects on learning. Our main contribution is to investigate whether such a program also impacts higher-order skills, such as social and emotional abilities.

To assess the impact of school management quality on social and emotional skills, we connected the schools that participated in the field experiment to a self-report instrument, called the SENNA instrument. It was applied to all 10th-grade students (high school) in the Brazilian state of Ceará in late 2015. The SENNA instrument is a high-quality self-report questionnaire that adopted several strategies to reduce the bias associated with self-report instruments, especially in developing countries ([Laajaj et al., 2019](#); [Laajaj and Macours, 2021](#)). This self-report instrument was validated in several aspects, presenting high internal consistency, high correlation with external variables (standardized tests and other validated instruments), and also included some strategies to reduce reference, acquiescence, and attention biases⁵.

⁴[Bloom et al. \(2015\)](#) analyzes 20 management practices divided into four management areas: operations, monitoring, target setting, and people. For a recent discussion about this taxonomy in education, see [Hwa and Leaver \(2021\)](#).

⁵For more details, see [section 3](#).

The intention-to-treat (ITT) estimates show that the school management program had a significant impact on self-management (0.036σ) and open-mindedness skills (0.033σ). This result is robust to various sensitivity and robustness analyses. In addition, coordinators who participated and achieved specific scores on coaching were qualified for certification. We used this certification to test whether this effect is related to school compliance with the program. The school's participation in the program is used as an instrumental variable for the pedagogical coordination certification, which allowed us to measure the treatment-effect-on-treated (ToT). The ToT estimates have the same effect size as the ITT estimates in both skills: 0.04σ for self-management and 0.037σ for open-mindedness. The other social and emotional skills are not affected by the school management program.

Self-management is associated with persistence, organization, determination, and efficiency. In turn, open-mindedness is related to creativity, curiosity, and artistic interest. There is a large literature that documents the importance of both variables for different long-run outcomes, as earning, college attendance, and health behaviors⁶. Moreover, the combination of these two skills is pointed out as being associated with a broader skill related to decision making or problem solving⁷. [Deming \(2021\)](#) documents the growing importance of this type of "composite skill"⁸ in the labor market, which he attributes to the impact of automation on jobs with its emphasis on the technological replacement of routine tasks by non-routine tasks that require more complex skills.

In addition to the main findings, we examined the presence of heterogeneous effects using the causal forest method developed by [Athey and Wager \(2019\)](#), [Athey et al. \(2019\)](#), and [Yadlowsky et al. \(2021\)](#). The causal forest method divides the space of variables using the random forest machine learning technique to obtain reliable estimates of the treatment effect in subgroups. This method identifies heterogeneous treatments in high-dimensional settings, allowing for a better understanding of who benefits from this program.

First, we find that the generalized causal forest identifies the presence of a heterogeneous treatment on both self-management and open-mindedness skills. Following that, we compute the most important variables for the forest split, which quantify the influence of some variables on the heterogeneous treatment effect. After that, we separate the student characteristics by quartiles of the predicted treatment effect for both variables⁹.

⁶See [Almlund et al. \(2011\)](#) for a detailed revision of this literature.

⁷These are sometimes called "compound" personality characteristics since they are found to be combinations of aspects of a number of individual skills and characteristics ([OECD, 2017](#)).

⁸Following [OECD \(2017\)](#), we define composite skill as the combination of two or more skills

⁹As suggested by [Davis and Heller \(2020\)](#), using the predicted treatment effect quartile helps reduce the prediction error of the

For both self-management and open-mindedness the most important factor explaining those who benefit most from the program is low socio-economic status. [Jackson et al. \(2020\)](#) found similar results considering a broad concept of school quality for US schools. One potential explanation for this finding is that less socially advantaged students may benefit more from effective schools because they may have more room for improvement. Furthermore, this finding is important because recent evidence shows an increase in inequality in social and emotional skills across cohorts, particularly for individuals at the bottom of the distribution ([Attanasio et al., 2020a](#)). Thus, raising the quality of management can contribute to reducing inequalities in terms of students' social and emotional skills.

We also used the generalized causal forest method to understand the mechanisms explaining the results. social and emotional skills are often developed through experiences that require students to practice these skills ([Dweck, 2017](#)). Most programs that focus on developing social and emotional skills offer different situations that induce individuals to practice self-management, emotional control, agreeableness, sociability, and others¹⁰. However, social and emotional skills can also be developed through informal learning activities that do not focus on practices for this purpose¹¹. Recent evidence has shown that teacher practices play an important role in the development of some social and emotional skills ([Algan et al., 2013](#); [Kraft, 2019](#); [Fleche, 2017](#); [Jackson, 2018](#)). Therefore, we explore whether changes in teachers' practices as a result of improved management quality are a potential mechanism for the program's impact on social and emotional skills.

In order to answer this question, we found that the school management program changed how teachers taught. In fact, the program increased teachers' average time spent on learning instruction by 8.5% while reducing classroom management and non-academic activities during classes. Then, we test if the increase in learning instruction correlates to a larger heterogeneous treatment effect on students' self-management and open-mindedness. According to our findings, increasing classroom instruction time predicts the largest quartile of treatment effects in both variables. This finding suggests that changes in the quality of school management may affect students' social and emotional skills if they also affect teachers' classroom practices.

Our paper contributes to a large and recent literature that investigates the effect of improvements in the quality of school management¹². In particular, we add to this literature that the impact of such programs is causal forest.

¹⁰See [Durlak et al. \(2011\)](#) and [Taylor et al. \(2017\)](#) for a recent review of many social and emotional interventions.

¹¹For instance, parenting can be seen as an example of informal social and emotional development ([Attanasio et al., 2020b](#); [Zumbuehl et al., 2021](#)).

¹²Some examples are: [Bruno et al. \(2018\)](#); [De Hoyos et al. \(2017\)](#); [Fryer et al. \(2017\)](#); [Romero et al. \(2020\)](#); [Bloom et al. \(2015\)](#);

not limited to learning outcomes but extends to more complex variables such as self-management and open-mindedness. Second, we also contributed to the importance of school management quality for developing countries. There are large differences in school management quality between developed and developing countries. This paper, combined with the evidence found by [Bruns et al. \(2018\)](#), shows that expanding school management quality has broad effects on students, which can be seen as a more attractive policy for developing countries since with just one initiative, it can affect multiple outcomes.

In addition to this introduction, this work is divided into six sections. The next section discusses the background, presents the school management program, and presents the experimental design; section three presents the data and the econometric strategy. The next section reports the main results, and section five discusses the potential mechanisms underlying the results. Lastly, section six presents the concluding remarks.

2 Context and Experimental Design

2.1 The context

The state of Ceará is located in the Northeast of Brazil, one of the poorest regions in the country. Ceará's per-capita GDP is nearly \$5,500, which is smaller than the average per-capita GDP in Brazil (close to \$9,800). The state's population is approximately 9 million, and the Human Development Index (HDI) is 0.68, close to Brazil, 0.69¹³. Secondary education in Ceará's state is divided into three tracks: regular, vocational, and indigenous education. Regular schools offer part-time education and teach only the standard secondary national curriculum, providing skills to students that they aim to apply to higher education at the end of secondary school. Indigenous schools teach only a specific indigenous curriculum and represent a small share of secondary schools in Ceará, nearly 1%. Vocational schools offer a full-day education and divide the curriculum between standard and vocational tracks¹⁴.

Public education in Ceará is recognized as one of the best in Brazil, especially primary education ([Loureiro et al., 2020](#)). Based on the National Index of Educational Quality (IDEB¹⁵) in 2015, primary ed-
[Leaver et al. \(2019\)](#); [Lemos et al. \(2021\)](#), and others.

¹³To put in perspective, Ceará's GDP is similar to countries like Nicaragua, Mozambique, and Albania. Moreover, the Ceará population is similar to Paraguay, a Latin American country.

¹⁴Currently, the state of Ceará has one more type of education for high school students: full-time schools. However, the construction of these schools began in 2017, two years after the school management program.

¹⁵IDEB is an educational quality index calculated biannually by the Ministry of Education (MEC). It is composed of two measures:

education in the state was ranked as the third best in the country. Meanwhile, it is ranked as one of the nine best in secondary education.

In 2015, the year the field experiment was implemented, the state of Ceará had 637 high schools with approximately 329,000 students. Nearby, 92% of these schools are located in urban areas. We will focus on 10th grade, the first year of high school (secondary education), which contains approximately 127,580 students enrolled.

2.2 The school management program

During the 2015 academic year, a school management program was implemented in 290 schools in Ceará to improve the quality of school management, especially focusing on aspects related to the monitoring of teachers and training of teachers and managers on "good" instructional and management practices. It was implemented by a team of researchers from the World Bank (Bruns et al., 2018) and was supported by non-profit entities, the Lehman Foundation, and by Ceará's state government.

The program had three main components: i) classroom observation feedback (delivered to teachers and pedagogical coordinators); ii) self-help materials (delivered to teachers and pedagogical coordinators) and iii) coaching support (delivered to the pedagogical coordinators).

I) Classroom observation feedback

Classroom observations were conducted at the end of the previous school year, in November 2014, using the Stallings observation method¹⁶. The feedback was communicated at the beginning of the 2015 school year through two-page infographic bulletin pages (see online appendix, Figs. A4 and A5). The classroom observation feedback was designed to be an informational shock on the quality of classroom conduct. It was expected that such feedback would expose differences in teachers' classroom practice, both inside and outside the classroom in Ceará schools, and in comparison with schools in other parts of Brazil and internationally established "best practices" benchmarks on the use of instructional time.

performance in standardized Portuguese and mathematics tests and school pass rates.

¹⁶The Stallings method, called the Stanford Research Institute Classroom Observation System, was developed in the 1970s by Professor Jane Stallings. This method consists of classroom observations every 5 minutes, corresponding to 15 seconds of observation each. The trained observers analyze the quality of the activities performed by the teachers and their interaction with the students. Due to its simplicity, it is appropriate for developing countries. More details on the method are provided in World Bank User Guide to application (WB, 2015). See also Bruns and Luque (2014); Bruns et al. (2018).

II) Teachers and pedagogical coordinators materials

A total of 4,680 *Teach Like a Champion* (translated into Portuguese as *Aula Nota 10*) books were distributed to all school principals, pedagogical coordinators, and all their teachers in the treatment arm. The book includes practical descriptions of useful techniques and online video examples. All school principals, pedagogical coordinators, and teachers had access to a special website designed by the implementer, which included video examples of good practices filmed in Brazilian classrooms, and videos uploaded from their own school (individual school materials were accessible only to their staff through a special code). They also recorded weekly online reports from all the coordinator's pedagogical sites on the number of classroom observations and feedback activities implemented in the school, specific issues identified and addressed, and an evaluation of progress. The online reports indicate that the average time coordinators spent on teacher observation, coaching, and feedback in the 2015 school year was about 111 hours per school. The site encouraged teachers and teaching coordinators to post video examples of good teaching practices in their school - both examples of classroom teaching and examples of teaching coordinators giving specific feedback to teachers after observing their lessons.

III) Coaching

The implementer team contracted a private company focused on educational consulting (ELOS consulting) to provide coaching for the pedagogical coordinators in two modalities: three one-day face-to-face workshops and individual coaching support via Skype. The workshops were delivered by the ELOS team at three different sites in the state of Ceará, and each had approximately 60-100 attendees. The training was developed by the ELOS team based on the book *Teach Like a Champion* by Doug Lemov. The focus of the training was to develop teaching coordinators' skills to better manage the classrooms. Specifically, the key objectives of the program were: i. Promoting a school culture of high expectations of learning and an ethos that every student can learn; ii. Lesson planning and strategies to promote student engagement; iii. Teacher training in classroom management and efficient use of instruction time; iv. Classroom observation and individual feedback to teachers by pedagogical coordinators as a school-level strategy for teacher development¹⁷. In practice, 88% of the pedagogical coordinators met the threshold for certification, which means that they performed at

¹⁷For a detailed description of the stages of the training, see [Bruns et al. \(2018\)](#), page 33-34.

least 75% of the activities, including attending the face-to-face training sessions, completing the online practice activities, and scoring highly in the videotaped teacher feedback sessions. The average for the group was 91% of all activities completed.

Additionally, an expert from the ELOS team was responsible for regularly interacting with the pedagogical coordinators via Skype. Each session was about 2 hours long, and the coaches helped the pedagogical coordinators prepare activities with their teachers and how to provide feedback and suggestions for improving the classes.

2.2.1 The impact of the program on the school management quality

[Bruns et al. \(2018\)](#) assessed the impact of the program on teaching classroom practices. They find that the program increased instructional time in the classroom, with an emphasis on demonstration/lecture, discussion/debate/Q&A, and copying activities. There was a reduction in teachers' time spent managing classroom activities. Additionally, teacher off-task¹⁸ time decreased, primarily about the teacher being out of the classroom. Also, student off-task¹⁹ time was reduced, especially regarding students' social interaction during class. In the Online Appendix, Figure A3, we provide additional evidence and found similar results to [Bruns et al. \(2018\)](#) by comparing the cumulative distribution of instructional time in the classroom, time spent in classroom management, teacher's off-tasks, and student's off-tasks in treated and control schools.

In summary, the program has achieved its goals of changing teachers' practices, reducing wasted time during classes, and increasing instructional time. As a consequence, [Bruns et al. \(2018\)](#) identified a significant increase in student learning on both low and high-stakes standardized tests. Therefore, given this exogenous variation in the quality of school management, our goal is to understand the impact of this program on students' social and emotional skills.

¹⁸Teachers off-task refers to a teacher's less social interaction in the classroom, a teacher not involved in classroom activities, and a teacher out of the room.

¹⁹Student off-task refers to increased social interaction with other students, uninvolved students, and discipline.

3 Data and Econometric Strategy

3.1 Data

3.1.1 Field experiment data

The field experiment was conducted by a World Bank team in partnership with the Secretary of Education of the State of Ceará (SEDUC). We had access to the microdata from the experiment that was made publicly available by the World Bank in its data repository²⁰. The data refer to the endline stage (follow-up) and contain information about the 290 schools participating in the program.

Particularly important for us, the microdata contains the official codes of the schools in the treated and control groups, allowing us to link the data from the field experiments to a survey conducted in late 2015 with the aim of measuring the self-management skills of 10th-grade high school students in the state of Ceará.

In addition, the data provided by the World Bank includes information on the monitoring conducted by observers within the classroom and on the participation of principals and pedagogical coordinators in training and coaching. We used this additional information to understand the mechanisms by which a change in the quality of school management could potentially affect students' social and emotional skills.

3.1.2 Measuring the social and emotional skills in Brazilian context

To measure social and emotional skills, we used a specific instrument applied to all 10th-grade (first academic year of high-school) public students in the state of Ceará in 2015. The instrument called the SENNA instrument, was developed by *Instituto Ayrton Senna*, a Brazilian civil society organization focused on providing public educational services. The SENNA instrument consists of a self-reported questionnaire containing 57 items and measures five social and emotional skills: self-management, open-mindedness, amity, engagement with others, and regulation of negative emotions, also called emotional stability. Open-mindedness is related to creativity, curiosity, and artistic interest. Self-management is associated with persistence, organization, determination, and efficiency. Engagement with others is related to being outgoing, having social initiative, and having enthusiasm. Amity, in turn, is correlated with compassion, trust, and respect for others. Finally, the regulation of negative emotions is connected with the modulation of stress and frustration. The definition of

²⁰The data were available in: <https://microdata.worldbank.org/index.php/catalog/3932/get-microdata>.

these follows the theoretical structure defined by the OCDE (OECD, 2017).

Approximately, 86% of public high school students in Ceará actually responded, corresponding to 109,606 students. In the schools selected to participate in the program (as treated or control schools), the response rate to the Senna Instrument was 94.6%. In Online Appendix, Table B1, we compared the characteristics of students in schools that participated in the program with those of other schools in Ceará, using the normalized difference (ND) (Imbens and Wooldridge, 2009). We found no difference greater than 0.25 in the normalized difference, indicating that students in participating schools are similar to those in schools not participating in the school management program.

The SENNA instrument is a high-quality self-report questionnaire. The psychometric characteristics of the SENNA were tested and presented a well-defined factor structure, high internal consistency (Cronbach's alpha: Self-management (0.94), Open-mindedness (0.90), Engagement with others (0.98), Amity (0.98), and Regulation of negative emotions (0.88)), and external validity when related to measures of performance in language and math test scores (Primi et al., 2021) and with other alternative social and emotional instruments.

Despite widespread use to measure social and emotional traits, self-report instruments are limited in several ways. The main limitation is the reference bias (Heckman et al., 2019) that is caused by students' differences in the interpretation (reference) of each item²¹. Reference bias affects self-report answers when comparing levels of personality skills among different groups of students. The SENNA instrument attempts to reduce reference bias by applying vignettes. The vignettes anchor the learner's perception, allowing them to adjust their answers when personality skills are compared between different groups (Primi et al., 2016). The SENNA version used in this paper (SENNA 2.0) contains four vignettes for each social and emotional skill²².

Additionally, the self-reported survey presents high acquiescence bias in developing countries (Laajaj et al., 2019; Laajaj and Macours, 2021), in which students tend to answer all items with a similar response pattern, regardless of the content of the question. To address this issue, the SENNA instrument included 13 items with reverse meaning, where answering "*I totally agree*" to a certain statement, for instance, indicates a negative aspect of the behavior. These items allow us to identify the presence of and adjust the estimates for

²¹ For instance, poor students may interpret the concept of persistence differently from non-poor students because they have different notions, promoted from their experiences, about what it means.

²²In fact, all students responded to at least one vignette for each social and emotional construct. The remaining vignettes were randomly distributed to the students and each student answered one additional vignette. This procedure was done to avoid losing students' attention while answering the survey.

acquiescence bias. We applied Primi et al. (2016)'s method of acquiescence bias correction.

Finally, The SENNA survey includes two items that measure the student's attention while filling out the instrument. These items ask students to respond to a specific answer to a given question²³. This type of item identifies whether students read the questions before answering them and is particularly important in long self-report instruments such as the SENNA. We do not exclude from the sample the students who wrongly answer these items. However, we used it in the robustness section to test if students' attention affected our main results. In summary, the SENNA instrument is a reliable tool for measuring the social and emotional skills of students in middle-income countries such as Brazil.

In summary, the SENNA instrument has good psychometric characteristics and employs many strategies to correct for the main biases present in self-report instruments, such as acquiescence bias, reference bias, and attention bias when filling out the items

3.1.3 Additional Data

We also used public Brazilian data from the Ministry of Education (MEC). We selected some pretreatment variables at the school level: average number of students per class and age-grade distortion. These data are available from the *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP)²⁴. We used this additional information in some specifications to control for school variations. Both variables allow us to characterize some important school factors. The average number of students per class correlates with both the school's infrastructure and the ratio between the number of schools per capita. In turn, the distortion-age-grade ratio is related to the quality of the students. A high proportion of this variable suggests that many students in that school were retained in some previous school stage.

3.2 Sample

The starting sample design contained 350 of the 573 schools that offered the full three-year high school cycle, corresponding to 61% of the high schools in the state of Ceará. Two of these schools closed before the start of the program, leaving only 348 schools. However, due to disruptions in the school calendar (holidays and other compulsory activities held by schools) and the attempt to observe the same classroom at baseline and

²³ For example: *In this question, mark option 3*

²⁴<https://www.gov.br/inep/pt-br/aceso-a-informacao/dados-abertos/indicadores-educacionais>

endline²⁵, the final sample contained only 290 schools, with 155 in the treatment group and 135 in the control group. The randomization process was conducted at the school level.

We had access to the endline, which contains only the 290 schools that actually participated in the field experiment. This prevents us from conducting balance tests between the schools that participated in the experiment and those that were excluded from the sample. However, [Bruns et al. \(2018\)](#) conducted several balance checks and concluded that the samples were balanced, suggesting that the exclusion of schools did not affect the sample characteristics of the schools in the experiment²⁶.

Classroom observations started in November 2014, spanning approximately one and a half months. The observers, in teams of 1 to 4, visited each school and observed between 6 and 24 classrooms. The number of observations depended on the size of the school. Classroom observations were conducted by a team from the Secretary of Ceará composed of supervisors from the central office and some staff from the administration of treatment schools. No school personnel from the control schools were involved in the Stallings method training in 2014 to avoid someone in those schools being familiar with the Stallings observation method and/or the training program. Field teams were assigned to districts other than their own to avoid any familiarity with the schools they were observing.

The endline of classroom observations was in November 2015. In the same month, the application of the state of Ceará's evaluation, SPAECE (System of Standardized Assessment of Learning of the State of Ceará), was administered. SPAECE is conducted annually to measure students' skills in language and mathematics and covers all students in the 2nd, 5th, and 9th grades of elementary school and, since 2013, a sample of the three grades (10, 11, and 12) of high school. Along with SPAECE, in 2015, the SENNA instrument was applied to measure the social and emotional skills of high school students.

3.3 Econometric Framework

Given the randomized nature of the assignment mechanism at the school level, the causal impact of being offered a chance to participate in the training and coaching program can be estimated by comparing

²⁵The implementers aimed to observe the same classrooms at the base and at the endline. Since the teachers were guaranteed anonymity, the classrooms observed were those that presented the same characteristics: grade, subject, and shift (morning or afternoon).

²⁶In particular the sample containing the 350 schools showed significant differences from the final sample only in the average proficiency in Portuguese (-4,764 points) and in mathematics (-7,082 points). See Table A.2 in [Bruns et al. \(2018\)](#).

social and emotional skills, our main outcomes, in schools selected or not for treatment. The intention-to-treat (ITT) effects are estimated using the following specification:

$$Y_{is} = \beta Treatment_s + X'_{is}\gamma + \varepsilon_{is} \quad (1)$$

Where Y_{is} are the outcomes of the interest of student i at school s that was randomly assigned to participate in the school management program. β is the parameter of interest and it captures the intention-to-treat effect of participating in the program on social and emotional skills.

Vector X_{is} contains pre-treatment measures of students' factors. These differ depending on the specification. In our main specification, we include age, gender (girls), racial status (black and brown), a binary variable indicating if the family participates in the cash-transfer program of the Federal government (*Bolsa Família*), and a binary indicator if the student has already reproved during his or her school path. We also include controls for the characteristics of the schools: average class size and the average rate of students not of appropriate age for 10th grade (also called distortion age-grade). Average class size is correlated with school infrastructure and population density around the school. In turn, the distortion age-grade measures students' abilities, since higher rates of this variable suggest the presence of students who have failed or dropped out of school in the past. We estimated [Equation 1](#) using OLS and clustered standard errors at the school level.

In the set of control variables, 17% had at least one missing observation. Therefore, our main specification corrected for missing controls for the baseline covariates. The imputation process assigned the overall sample average to each observation with missing information for a continuous control variable and a new missing category for each observation with missing information for an indicator variable. In [Online Appendix, Table C6](#), we regress an indicator by taking the value of one if control variables are missing against the treatment status. The analysis shows that the treatment and control groups do not differ in their probability of having missing control variables. In addition, in the robustness section, we regress the same main specification without correcting for the presence of missing covariates. The results are very similar, indicating that the missing correction does not affect our conclusions.

[Equation 1](#) aims to measure the intention-to-treat (ITT) effect, which represents the impact of being offered a chance for some schools to participate in the experiment. However, the treatment effect depends crucially on the pedagogical coordinator's participation in the program activities. The pedagogical coordinators

were responsible for organizing training sessions for the teachers in their school²⁷. In addition, they were requested to monitor each teacher in their school at least once and to share their observations with the assigned coach via online calls.

At the end of the program, each coordinator was assigned a final "grade" ("poor", "adequate", "good", or "excellent") based on the feedback reports they prepared for the teachers they observed and their communication skills during feedback meetings with the teachers. A certification was offered to coordinators who participated in at least 75% of the face-to-face and online activities and who achieved an average score of at least 3 ("good") on the feedback activities. The program presents a high compliance rate, 88% of pedagogical coordinators achieved certification.

To assess whether differential compliance affected outcomes, we estimated a Treatment-effects-on-treated (ToT) to measure the impact of the program on schools in which the pedagogical coordinator received a certification. The take-up rate is relevant to the impact of school management programs because there are several intermediate stages between the initial intervention targeting a school leader's management and the final outcome of student learning. We used the school randomly assigned to the program as the instrumental variable (IV). Specifically, we estimate a two-stage least-squares (2SLS), wherein in the first stage, we regress the random assignment into the program in the school ($Treatment_s$) to predict the pedagogical coordinator's certification (c_{is}) in the school s for student i , as follows:

$$c_{is} = X'_{is}\gamma_1 + \pi Treatment_s + e_{is} \quad (2)$$

Where X'_{is} is the same vector of covariates used in the ITT estimation. In the second stage, we regress the social and emotional scores on the predicted certificate obtained from the first stage.

$$Y_{is} = \alpha c_{is} + X'_{is}\gamma + \varepsilon_{is} \quad (3)$$

3.3.1 Inference

We estimate the standard errors clustered at the school level. However, the recent paper by [de Chaisemartin and Ramirez-Cuellar \(2020\)](#) shows that standard errors clustered at the school level would be biased.

²⁷These training sessions go through key techniques from the Lemov book, such as strategies for planning engaging lessons and using questions to draw out examples and explanations from the students themselves, rather than simply lecturing.

Because of this, we will adopt different strategies for estimating the standard errors to check the robustness of the estimates. First, we also present randomization inference *p-values* using the randomization protocol and 1,000 placebos that maintain the clustered structure of the original assignment mechanism. In this case, the *p-values* for each estimate is the proportion of placebo estimates that are larger (in absolute value, in the case of a two-sided test) than the "actual" estimate.

Our study analyzes the impact of the school management program on five outcome variables, therefore, it is possible that there may be problems with multiple hypothesis testing. We estimate adjusted *p-values* using the [Romano and Wolf \(2005a, 2016\)](#)'s procedure. This procedure uses re-sampling methods, such as the bootstrap, to asymptotically control of the family-wise error rate (FWER), that is, the probability of rejecting at least one true null hypothesis in the family of hypotheses under test. It is more suitable for our case, compared to other methods such as the False Discovery Rate (FDR) procedures, because it accounts for any correlation between the outcomes, which is expected among social and emotional skills ([Clarke et al., 2020](#)). Finally, we also reported the bootstrap standard errors clustered at the school level.

3.4 Balance

We test the balance of characteristics between the treatment and control samples at the student and school levels. Since we do not have access to baseline variables, we only checked the balance on variables determined prior to 2015, the year of the intervention. In particular, we regress each pretreatment characteristic on the treatment status separately. We use all available variables on students, and we estimate a total of 19 regressions²⁸. We also use these variables in heterogeneous analyses.

[Table 1](#) summarizes the estimates, presenting individual regressions for four groups of student characteristics: demographic and parental factors, prior education, and socioeconomic status. Column (1) shows the estimated coefficients. Column (2) shows the estimated standard errors, and Column (3) presents the *p-value*. Overall, [Table 1](#) suggests that the randomization was successfully implemented: only student black status presents a parameter estimate significantly different from zero at 5%.

We also test if there are average differences between schools participating in the school management program and the control group. We compared the schools using pretreatment variables at the school level. The

²⁸We estimate the standard errors by clustering at the school level in each regression.

results are presented in [Table A1](#). We observed no significant differences between the schools, except for the variable school dropout rate, which showed a significant difference at the 10 percent level.

Table 1: Balance check of pretreatment variables at student level

Student variables	Treatment Coefficient	Standard Error	p-value
Demographic factors			
Age	0.002	(0.004)	0.584
Girl	0.009	(0.007)	0.182
White	0.011	(0.010)	0.268
Brown	0.004	(0.008)	0.61
Black	-0.028**	(0.013)	0.033
Other racial status	-0.006	(0.009)	0.552
Parents factors			
Lived with both parents	0.006	(0.012)	0.641
Parents help to study	-0.004	(0.008)	0.615
Mother education: Never Studied	-0.010	(0.011)	0.379
Mother education: Primary Education	0.002	(0.015)	0.893
Mother education: Middle Education	-0.007	(0.010)	0.471
Mother education: Secondary Education	-0.009	(0.009)	0.330
Mother education: Tertiary Education or higher	0.002	(0.022)	0.933
Prior education			
Reproved	-0.007	(0.017)	0.686
Pre-School	0.010	(0.011)	0.398
Socioeconomic status			
Distance to school (hours)	0.003	(0.008)	0.676
Cash transfer program	0.017	(0.014)	0.204
Number of people in family	0.001	(0.003)	0.827
Socioeconomic Index (SES)	-0.007	(0.010)	0.460

Note: [Table 1](#) presents the balance of pre-treatment variables at the student level. Specifically, we regress the assigned school treatment against the pre-treatment variables individually. All regressions are pooled at the school level. The first column shows the estimate of the treatment effect. The second column shows the standard error estimate. The third column shows the p-value. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4 Results

4.1 Effect of school management improvement on students' self-management skill

Table 2 presents the intention-to-treat (Equation 1) estimates that measure the impact of offering a chance for some schools to participate in the school management program on students' social and emotional skills and the treatment effects on the treated (ToT) results, which take into account the compliance rate among school leaders. We report the estimates of our reference specification, which includes students' and schools' controls. In the robustness section, we vary this specification.

The estimates are positive for all social and emotional skills, however, they reject the null hypothesis of no treatment effect at 5% only for self-management and open-mindedness. In the ITT, the treatment effect size on self-management is 0.036σ and 0.033σ for open-mindedness. In both cases, this is a small effect size when compared to interventions focused on social and emotional development. In a recent meta-analysis of the literature, Taylor et al. (2017) reviewed 82 school-based interventions and found an estimated average effect size of 0.23σ for social and emotional development programs. This indicates that improving the quality of school management accounted for approximately 16% percent of the average impact of programs focusing on the development of social and emotional skills. It is important to note, however, that the school management program was not designed to enhance students' social and emotional skills.

The ToT estimate shows a larger treatment effect size, 0.040σ for self-management and 0.037σ for open-mindedness, indicating that the pedagogical coordinator's participation in the program contributes to the effect on social and emotional skills. The first stage estimate, reported in the online appendix (Table B4), shows that the treatment predicted coordinator certification, rejecting the null hypothesis (0.90 (*p-value* 0.000)).

Three factors help to put the magnitude of treatment's effect on social and emotional skills into perspective. First, social and emotional skills are more malleable in periods prior to adolescence and tend to be less sensitive to education interventions during adolescence (Soto et al., 2011). The school management program affected students' social and emotional skills in a less malleable period of developing these skills. Second, Durlak et al. (2011) shows that social and emotional programs are most effective if they employ a step-by-step sequential training approach, active forms of learning, devote sufficient time to skill development, and have explicit learning objectives. They refer to these program features as SAFE (an acronym for Sequenced, Active,

Focused, and Explicit). Without SAFE practices, the effect size of different programs on social and emotional skills was very small and non-significant (Average Effect: 0.01σ). Since the school management quality program was not focused on promoting social and emotional skills, it lacks SAFE features. Nonetheless, it had a significant impact on both important skills.

Third, in 2015, the state of Ceará launched a program to improve students' and teachers' social and emotional skills. The program was offered to 80 high schools, with 23 in the control group and 18 in the treatment group. In our sample, we regress participation in such social and emotional programs on self-management and open-mindedness skills. Although the estimates cannot be interpreted as causal, it is expected that the social and emotional program is correlated with these skills. The results are detailed in the appendix, [Table A4](#) and [Table A5](#). We regress both skills on the indicator of schools participating in the social and emotional program in column (1). Participation in the social and emotional program has no correlation with self-management or open-mindedness. In column (2), we interacted with social and emotional program participation in schools that also participated in the school management program. We do not find that participation in the social and emotional program increases the effect of the school management program on self-management or open-mindedness. Surprisingly, the results indicate that the school management program was more effective in improving self-management and open-mindedness than a program specifically designed to foster students' social and emotional skills.

Self-management skill is related to the ability to focus attention and behavior on the relevant things when we need to meet standards. It is correlated with other social and emotional factors such as grit ([Almlund et al., 2011](#)), persistence, determination, and focus ([Soto and John, 2017](#)). The literature documents that self-management skills affect long-term individual outcomes, like college attendance, high school or university graduation, and others associated with endurance and focus on long-run objectives ([Heckman and Mosso, 2014](#); [Almlund et al., 2011](#); [Heckman et al., 2019](#)).

In turn, open-mindedness is related to curiosity, creativity, and tolerance for diversity. As a result, open-mindedness is associated with unconventional thinking and creativity, enabling us to think differently and do things in new and better ways. In addition, to be open, the student must be tolerant of different points of view, value diversity, and learn to respect differences in backgrounds, perspectives, and cultures. Beliefs in one's ability to understand complex topics (self-efficacy), learn quickly, learn most subjects (academic self-

concept), and perform well in math and language (math and verbal self-concept) have strong correlations with self-management and open-mindedness.

A recent shift in the demand for labor has been documented due to the introduction of automation. Job tasks have become open-ended and require workers to make decisions and adapt to unexpected situations. Skills such as problem-solving and critical thinking are consistently ranked as the most essential needs among new hires (Deming, 2021; Acemoglu and Autor, 2011). The combination of these two skills, self-management, and open-mindedness, is associated with these new demands for jobs, enabling students to be more adaptable to the requirements of employers.

Table 2: Impact of School Management Program on student's social and emotional skills

Variables	Self-management		Amity		Engaging		Emotional stability		Open-mindedness	
	(1) ITT	(2) ToT	(3) ITT	(4) ToT	(5) ITT	(6) ToT	(7) ITT	(8) ToT	(9) ITT	(10) ToT
Treatment	0.036** (0.0174)	0.040** (0.0191)	0.025 (0.0202)	0.027 (0.022)	0.012 (0.0141)	0.013 (0.015)	0.017 (0.0126)	0.019 (0.0138)	0.033** (0.0168)	0.037** (0.018)
Observations	51,853	51,853	51,853	51,853	51,853	51,853	51,853	51,853	51,853	51,853
R-squared	0.039	0.039	0.054	0.053	0.012	0.012	0.044	0.044	0.016	0.015
Student control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Table 2 presents the treatment effect of school participation in the management program on the five social and emotional skills: Self-management, Open-mindedness, Regulation of Negative Emotions (also called Emotional Stability), Friendship, and Engagement with Others. For each social and emotional skill, we regressed the intention to treat (ITT) and the treatment-effects-on-treated (ToT), which used the random variable assigned to the program as the instrumental variable (IV) for teaching coordinator certification. We included student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already reproved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

4.2 Robustness check

In this section, we present some robustness checks on the estimates shown in [Table 2](#). We focus mainly on self-management and open-mindedness skills.

4.2.1 Inference

The estimates presented in [Table 2](#) may be affected by multiple-testing problems. To address this issue, we re-estimated the ITT and computed the *p-value* using the Romano-Wolf procedure ([Romano and Wolf, 2005b, 2016](#)). In addition, we also reported the bootstrap standard errors and randomization inference *p-value* using the randomization protocol and 1,000 placebos that maintain the clustered structure of the original assignment mechanism. The results are shown in [Table A7](#). Our estimates of standard errors and *p-values* do not change markedly between specifications and do not affect which coefficients are significant at conventional levels.

4.2.2 Missing value

The results are shown in [Table 2](#) account for missing values in covariates. We replace each missing observation with the average of the variables and include an indicator variable that assigns the missing observation a value of one. To determine whether the missing value imputation affects the estimates of the impact of the school management program on self-management and open-mindedness, we re-estimate the main specification without performing the correction. The findings are shown in [Table A3](#). The estimates are quite similar to [Table 2](#). Then, we conclude that correcting for the presence of missing values has no effect on our main findings.

4.2.3 Student's attention

The SENNA instrument contains 57 items, and the large number of items might affect the quality of student responses. Students' attention is critical when completing the questionnaire to reduce measurement errors because the social and emotional items require students to evaluate sensitive situations.

The SENNA instrument introduced two items to capture the student's attention. Students must fill in the blanks with a specific answer indicated in the statement of each question. As an example, "*In this item, we*

would like to know if you read all of the questions carefully. Please, mark the option b". To check whether student attention affected the identification of the treatment effect, we tested for the presence of the heterogeneous treatment effect in students who correctly answered the attention both check items. We subsequently interacted with the treatment variable and the student's attention status, an indicator variable that assigns 1 if the student answer correctly both attention items. If the student's attention when filling out the questionnaire matters, then we expect the treatment effect to be different for students with more or less attention.

The results are shown in [Table A2](#). Students' attention to completing the questionnaire significantly affects all measures of social and emotional skills. However, we do not observe that the treatment effect differs between more and less attentive students.

4.2.4 Contamination from others programs

During the field experiment, the Ceará Secretary of Education implemented three other programs. A social and emotional learning program offers a specialized curriculum designed to improve the social and emotional skills of both teachers and students. This program included 80 high schools, with 23 in our control group and 18 in the treatment group. Second, a program known as *Tutoria Pedagógica*, which has similar goals to the school management program, and focuses on fostering community learning. This program, however, was in its pilot phase in 2015 and was implemented in only ten schools, with two in the treatment group and none in the control group.

Finally, the *Jovem de Futuro* program was implemented concurrently with the school management program. This program also emphasized management and accountability. Since 2012, it has reached 216 secondary schools in the state of Ceará. Both Waves 1-3 (2012 to 2014) and Wave 4, carried out in 2015, may contaminate our treatment group. In 2015, the fourth wave of the *Jovem de Futuro* was offered to 22 schools, 14 in our control group and 8 in our treatment group.

To test if these programs contaminated the school management program, we interacted school participation in the school management program with the other programs: social and emotional learning program and *Jovem de Futuro*²⁹. The results are presented in the [Table A4](#) and [Table A5](#). First, we regress the correlation of the social and emotional learning program and *Jovem de Futuro* with self-management and open-mindedness

²⁹We did not test the interaction effect of the school management program with the *Tutoria Pedagógica* program because it was in a pilot phase in 2015, and only two schools in our treatment group participated.

skills in our sample (columns (1), (3), and (5)). For the *Jovem de Futuro* program, we regressed two cases, according to the implementation phase of the program: participation in at least one of the waves (2012-2015) and participation specifically in 2015 (Wave 4). The estimates do not indicate that the programs predicted student self-management or open-mindedness in our sample. Columns (2), (4), and (6) show the interaction effect, which does not indicate the presence of contamination, except for the open-mindedness skill, which showed negative and significant estimates for the fourth wave of the *Jovem de Futuro* program.

4.2.5 Alternative outcomes related to self-management skill

Finally, social and emotional skills, especially self-management and open-mindedness, are associated with a set of expected student behaviors such as reduced absenteeism, aspiration for future individual success, and current study activities. The SENNA instrument collected additional data on these factors, which we used to evaluate whether the treatment effect extended to these variables. In addition, we also analyze if the school management program affects the student's progression to the next grade and their graduation from high school. We estimate a specification similar to [Equation 1](#), replacing the dependent variable with the student's self-reported number of absences in the last month³⁰, a binary indicator of if the student plans to enter college after high school (aspiration, hereafter), self-reported indicating that the student does not study at home, progression to the next grade, and graduation in secondary education. Estimates are presented in [Table A6](#). Participation in the school management program reduced self-reported student absence, increased student aspiration, decreased the proportion of students who reported not studying at home, expanded the progression to 11th grade, and increased secondary education graduation. The estimates, however, are remarkably imprecise, and we only reject the null hypothesis of no treatment effect on student aspiration. Possibly, the small effect of the school management program on social and emotional skills explains the imprecision of the estimates.

4.3 Heterogeneous effect

We have two main reasons for estimating the heterogeneous effect of the school management program. First, we are interested in knowing who benefited most from the program in social and emotional skills, and

³⁰This variable measures the number of times the student has been absent from class in the last month. We assigned a value of 1 for no absences, a value of 2 for at least one absence, a value of 3 for at least two absences, a value of 4 for at least three absences, and a value of 5 for more than three absences in the previous month.

how large the effect size is. Second, treatment heterogeneity can help understand the mechanisms underlying the results by identifying the subgroup of students who are most affected by the school management program on social and emotional skills.

We study the treatment effect heterogeneity by implementing the generalized causal forest method (hereafter, GRF), developed by [Athey et al. \(2019\)](#), which uses the random forest machine learning method to determine the Conditional Average Treatment Effect (CATE). In the heterogeneous analysis, we focus our attention on self-management skills and open-mindedness. The causal forest predicts an individual's expected treatment effect for each outcome based on his covariates. Unlike more standard heterogeneity tests using interaction effects, this strategy lets us isolate the most responsive student without limiting ourselves to single splits or linear functions of one covariate.

To present the idea behind the GRF, assume the following model:

$$Y_{is} = \tau_{is} \times D_{is} + u_{is} \quad (4)$$

Where: Y_{is} is a measure of the social and emotional skill of student i at school s , D_{is} refers to school s participation in the school management promotion program, and u_{is} is an error term. Our interest is the conditional average treatment effect $\tau(x) = \mathbb{E}(\tau_{is}|X_{is} = x)$, which in our case is the average effect of student i with certain predetermined characteristics x of the covariate vector X . For estimation of $\tau(x)$, the generalized causal forest method splits the covariate space into leaves using local moment equations³¹. This procedure yields the causal forest weighting estimation of $\hat{\tau}(x)$, defined as:

$$\hat{\tau}(x) = \sum_{\{i: D_{is}=1\}} \frac{w_i(x)}{\sum_{\{i: D_{is}=1\}} w_i(x)} Y_i - \sum_{\{i: D_{is}=0\}} \frac{w_i(x)}{\sum_{\{i: D_{is}=0\}} w_i(x)} Y_i \quad (5)$$

where $w_i(x)$ is a weighting scheme that captures the frequency with which the observation i falls on the same leaf as the x . The weights ($w_i(x)$) are determined by the random forest method, originally developed by [Breiman \(2001\)](#). The causal forest estimator estimates $\tau(x)$ by taking the difference in weighted average outcomes between the treated and untreated individuals. Specifically, for a set of trees $b = 1, \dots, B$, the weight

³¹See the online appendix or [Athey and Wager \(2019\)](#) for details about the generalized causal forest and our implementation procedure.

$w_i(x)$ for student i in the school s is obtained as follows:

$$w_i(x) = \frac{1}{B} \sum_{b=1}^B \frac{\mathbb{I}\{i \in L_b(x)\}}{n_b(x)} \quad (6)$$

where $L_b(x)$ is a set of all indices for the students that are in the same leaf as a point x in tree b , and $n_b(x)$ is the number of students that fall into the same leaf as x in tree b .

In our implementation approach, we estimate the GRF using a large set of policy-relevant covariates measured at or before random assignment. This includes parental presence at home, parental engagement, demographic and socioeconomic characteristics of students, and the mother’s education. In total, we have 23 variables³². As discussed by [Davis and Heller \(2017\)](#), implementing the GRF procedure requires researchers to choose three parameters: (1) the number of trees in the forest; (2) the minimum number of treatment and control observations allowed on a leaf; and (3) the sub-sample size. We define 10,000 trees in the forest, set the minimum number of treatment and control observations allowed on a leaf equal to 10, and use the default choice of sub-sample size from the *grf* R package.

An additional issue refers to the clustered structure of school data. We adopt a similar approach to [Davis and Heller \(2020\)](#), adjusting the GRF estimate for differences in treatment probabilities using inverse probability weights (IPW). This transformation effectively controls for differences in treatment probabilities across schools by re-weighting the number of treatment and control observations to equal the total school size.

In [Figure 1](#), we show the variable importance estimate that indicates the relative frequency with which a forest splits on the covariate X_q , $q = 1, \dots, 23$, across all trees grown. The definition of each variable is presented in the online appendix. We restricted the [Figure 1](#) to the fifteen most important variables for both self-management and open-mindedness skills. It measures which variables the conditional mean treatment effect can vary most. Variable importance ranges from 0, if the forest never splits on the covariate X_q , to 1, if the forest always splits on X_q .

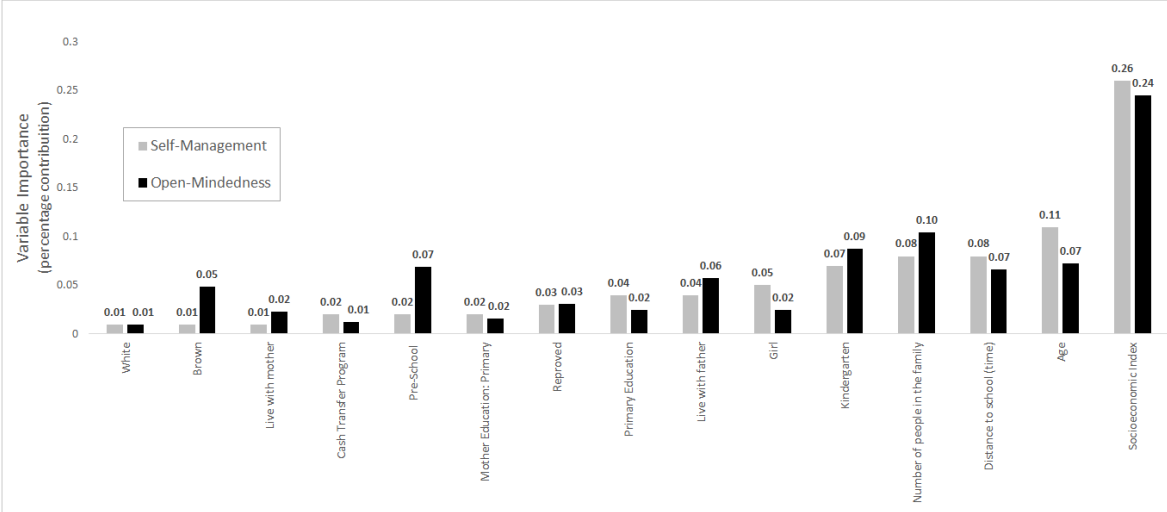
We note from [Figure 1](#) that variables related to student socioeconomic status have a large importance on treatment heterogeneity. The variables socioeconomic index³³, distance to school, and the number of family members are all related to the student’s socioeconomic status and add up to nearly 41% of the forest’s

³²See the online appendix for a detailed description of each variable used in this exercise.

³³We estimate the socioeconomic index using the first principal component of a set of 10 variables related to the socioeconomic assets present in the student’s home or neighborhood.

importance for self-management and open-mindedness. Student age is also a relevant variable for treatment effects. Parental factors (parents’ presence at home, mother’s education, and parent engagement) have small importance in determining the treatment effect of the school management program in both variables.

Figure 1: Variable Importance for heterogeneous treatment effect



Note: Figure 1 presents the measure of variable importance of self-management and open-mindedness social and emotional skill. The variable importance is related to the relative frequency with which some covariates are used to splits on the random forest process. Variable importance ranges from 0, if the forest never splits on a specific covariate, to 1, if the forest always splits on this variable.

Figure 1 shows that socioeconomic status (SES) is the most important variable in explaining treatment heterogeneity according to the GRF method. To investigate this evidence in more detail, we estimate a subgroup analysis that divides students into groups below and above the median socioeconomic index. The estimates are presented in Table 3. We observe that students with low socioeconomic status (below the median) are the most positively impacted by self-management. The school management program affects students below the median SES index by 0.045σ . In turn, the treatment effect of students above the median is 0.021σ , considering the specification that includes school and student controls. The difference is statistically significant at 1%. In the case of open-mindedness, there is a significant difference according to low socioeconomic status; however, we only observe a significant effect on students below the median SES index in the ToT estimates. These results suggest that the school management program affects socially disadvantaged students the most, reducing the potential inequality in social and emotional skills between the two groups.

The developmental deficits of poor children have been documented in a variety of contexts (Attanasio et al., 2022). Jackson et al. (2020) found similar findings when taking a broad view of school quality for US

schools. One argument is that children from less privileged families may be more affected by the improvement in school quality since they may have more potential for developing their abilities. Recent evidence shows an increase in inequality in social and emotional skills across cohorts, particularly for individuals at the bottom of the distribution ([Attanasio et al., 2020a](#)). Our findings suggest that improved school management may contribute to reducing social and emotional developmental deficits caused by poverty in developing countries.

Table 3: Heterogeneous Effect of School management program on student's self-management and open-mindedness

Panel A	Dependent variable: self-management skill			
	(1) ITT	(2) ITT	(3) ToT	(4) ToT
	Below Median	Above Median	Below Median	Above Median
Treatment	0.0479** (0.0223)	0.0251 (0.0175)	0.0522** (0.0242)	0.0280 (0.0194)
Effect Size Difference Test		0.023*** [0.022; 0.023]		0.024*** [0.023; 0.024]
Observations	22,162	29,691	22,162	29,691
R-squared	0.035	0.039	0.035	0.039
School Controls	Y	Y	Y	Y
Student Controls	Y	Y	Y	Y
Panel B	Dependent variable: open-mindedness skill			
	(1) ITT	(2) ITT	(3) ToT	(4) ToT
	Below Median	Above Median	Below Median	Above Median
Treatment	0.0346 (0.0226)	0.0274 (0.0174)	0.0473* (0.0250)	0.0305 (0.0193)
Effect Size Difference Test		0.007*** [0.006; 0.007]		0.016*** [0.016; 0.017]
Observations	22,601	30,325	22,162	30,325
R-squared	0.012	0.039	0.035	0.039
School Controls	Y	Y	Y	Y
Student Controls	Y	Y	Y	Y

Note: Table 3 presents the heterogeneous treatment effect of school participation in the management program for students of low and high socioeconomic status on the social and emotional skills of self-management and open-mindedness. We interacted one binary indicator of below and above socioeconomic index (SES) with the treatment variable and included this binary indicator as a covariate. Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

In addition to estimating variable importance, we extended our analysis to understand which variables explained the students who benefited the most from the program. The GRF estimates the predicted treatment effect, which contains prediction errors. To minimize the presence of prediction errors, we divided the observations into two groups based on predicted treatment heterogeneity: the top quartile of prediction impact and the rest of the sample. Observations far from the top quartile cutoff are less likely to be misclassified and could potentially identify the students who have benefited the most from the school management program.

First, we examined whether the largest quartile predicted treatment effect adequately captures treatment heterogeneity in both self-management and open-mindedness compared to the rest of the sample. Specifically, we performed subgroup analysis by interacting the indicator variable of the largest quartile of predicted treatment with the treatment variable. Table B2, in the online appendix, presents the estimates. The interaction between the indicator of the largest predicted treatment effect and schools participating in the program has a larger differential effect on self-management, suggesting that this group has a heterogeneous positive effect relative to the rest of the sample. In particular, in column (3), where we included school and student covariates, the interaction effect estimate on self-management is 1.271σ (p -value 0.000) and 0.561σ (p -value 0.000) for open-mindedness. Based on these results, we conclude that the causal forest does identify a group that benefits from the treatment of both social and emotional skills.

We use this variation in self-management and open-mindedness to describe the predetermined factors that determined who benefited from the program. Table 4 shows descriptive statistics for the largest group of predicted treatment effects relative to the rest of the sample. We also calculate the mean difference test. The students who most benefited in self-management skills from the school management program are older than the rest of the sample, and 53% are boys. Only 32% live with their father, in contrast to the rest of the sample, where 41% reported the presence of their father at home. However, the group of students who benefited the most, 32% reported that their father helped them study, a difference of 3.8 percentage points more than the rest of the sample. Finally, we observed a large difference in terms of the socioeconomic index and family members participating in the federal cash transfer program *Bolsa Família*. Students in the group most positively affected by the program have low socioeconomic status and receive less assistance from public programs to alleviate poverty.

In the case of open-mindedness, the students who benefited most from the school management program

were the youngest and most female. They live less with their father, but receive more assistance from their parents in school activities. They fail less and have a better educational background. Finally, although socio-economic status is the most important variable, the students who benefited most from open-mindedness were less poor compared to the rest of the sample.

The differences between the treatment effects of the school management program on self-management and open-mindedness emphasize the importance of personalizing the teaching of social and emotional skills. In fact, only 42% of students are in the largest quartile of predicted treatment effects on both social and emotional skills³⁴, suggesting that the effect of changing a school factor on such skills depends crucially on student characteristics.

5 Explaining the effect of the school management program on social and emotional skills

Social and emotional skills can be developed through formal and informal learning experiences. Many programs are specifically designed to develop students' social and emotional skills; however, this is not the case with the school management program implemented in Brazilian schools. As a result, the impact of the school management program on self-management and open-mindedness may be explained by the informal learning experiences that students in the treated schools are exposed to. We will focus on one potential mechanism: the shift in teachers' classroom practices.

The impact of teacher practices on complex skills, such as social and emotional skills, is well documented in the literature. [Algan et al. \(2013\)](#), through a cross-country analysis, found that teachers' practices affect students' beliefs and social capital skills. [Kraft \(2019\)](#) studies the impact of teachers on grit and growth mindset in six large US school districts as part of the Measures of Effective Teaching (MET) Project. Grit, in particular, refers to students' propensity to maintain interest and effort to achieve long-term goals, and is closely related to self-management abilities. He finds a great impact of the teacher on a growth mindset, effort in class, and grit. Similarly, [Jackson \(2018\)](#) found that the teacher effect on students is greatest on a set of variables related to social and emotional skills, such as absences, suspensions, grades, grade retention, and

³⁴In the appendix, we show in the [Figure A1](#) the intersection between both predicted treatment effects. We observe that 58% of the students are in only one largest predicted treatment effect quartile.

Table 4: Heterogeneous Effect

Panel A	Rest of Sample	Self-management skill		Mean Difference
		Largest Quartile		
Age	15.723	15.861	-0.138	***
Girls	0.539	0.47	0.069	***
Mother Education	0.596	0.584	0.012	
Lives with father	0.41	0.325	0.085	***
Parents help to study	0.29	0.328	-0.038	***
Reproved	0.275	0.272	0.002	
Kindergarten	0.661	0.642	0.019	**
Preschool	0.822	0.818	0.004	***
Socioeconomic Index	0.019	-0.232	0.251	***
<i>Bolsa Família</i> Cash Transfer	0.609	0.585	0.023	***
Number of Observations	30020	4278		

Panel B	Rest of Sample	Open-mindedness		Mean Difference
		Largest Quartile		
Age	15.758	15.618	0.140	***
Girls	0.537	0.484	0.053	***
Mother Education	0.604	0.526	0.078	***
Lives with father	0.411	0.313	0.098	***
Parents help to study	0.289	0.336	-0.047	***
Reproved	0.281	0.225	0.056	***
Kindergarten	0.653	0.702	-0.049	***
Preschool	0.810	0.901	-0.090	***
Socioeconomic Index	-0.017	0.023	-0.040	**
<i>Bolsa Família</i> Cash Transfer	0.608	0.586	0.022	***
Number of Observations	30111	4187		

Note: Table 4 shows mean baseline characteristics for the largest quartile of predicted self-management (Panel A) and open-mindedness (Panel B) treatment impacts. Predictions from a causal forest. The last column presents the mean difference. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

high school graduation³⁵. All of these articles suggest that the teacher's role in the classroom impacts abilities other than those measured by standardized tests.

We are interested in understanding if the change in teachers' practices, carried out by the school management program, affected students' social and emotional skills. To that end, we investigate the association between teachers' classroom practices and the heterogeneous treatment effects computed by the generalized causal forest method (GRF). Specifically, we regress the measures of teachers' practices, aggregated at the school level, on the binary indicator of the largest quartile predicted treatment effect. We expect that some teachers' practices are associated with the highest predicted student treatment effects.

To assess teachers' practices in the classroom, we used Stalling's classroom observation method applied at the end of the intervention. Stalling's method generates quantitative measures of teacher-student interactions in the classroom and has two important advantages: it does not require extensive training for field observers, which reduces measurement error, and it is curriculum-neutral, allowing comparisons between different types of schools and country contexts. The instrument measures four main teacher practices in the classroom: 1. Teachers' use of instructional time; 2. Teachers' use of materials; 3. Core pedagogical practices; and 4. Teachers' ability to keep students engaged. It is important to emphasize that Stalling's instrument does not aim to analyze the content of what is taught, but instead focuses on the time spent by each teacher on some practices.

Stalling's classroom observation method has three major drawbacks. First, because teachers are aware of the observer's physical presence in the classroom, they can change their behavior, a phenomenon known as the Hawthorne effect. As a result, we believe Stalling's observations capture teachers' performance at the frontier of their production capabilities. Second, because the variables being measured by the instrument may be noisy at the teacher level, the results are considered valid only at the school, region, or school system level(WB, 2015). Furthermore, student sorting in the same school's classroom may confound the direction of causality between teacher practices and student outcomes. That is, we can not determine whether students' outcomes are influenced by better classroom management or whether teachers can manage the classroom better because their students are more motivated. We aggregate teachers' practices at the school level due to the previous two constraints. This procedure reduces noise and diminishes the importance of student sorting.

In our approach, we consider three variables related to teachers' classroom practices: the proportion of

³⁵Other related recent papers include: [Blazar and Kraft \(2017\)](#), [Fleche \(2017\)](#), [Liu and Loeb \(2021\)](#), and [Blazar and Pollard \(2022\)](#).

teachers' average total class time devoted to learning activities, the proportion of teachers' average time devoted to classroom management, and the proportion of teachers' average time devoted to non-academic activities. Learning activities include reading aloud, demonstration/lecture, discussion, practice & drill, assignment/class work, and copying. In turn, classroom management refers to the following practices: verbal instruction, discipline, classroom management with students, and classroom management alone. Non-academic activities refer to social interaction with students, teacher social interaction with someone other than students (or teacher uninvolved), and teacher out of the room³⁶. We aggregate the proportion of teachers' time devoted to each school-level practice. Therefore, the three variables sum up to one and represent the proportion of teachers' time devoted to each specific group of classroom activities.

We are interested in the following hypotheses:

H_a^1 : The school management program promotes a substitution effect on teachers' classroom practices, increasing learning activities while reducing non-learning activities (classroom management and non-academic activities).

H_a^2 : The increase in learning activities, and consequent decrease in non-learning activities, correlate with the heterogeneous treatment effect on self-management and open-mindedness.

To test the first hypothesis, we show that schools that participated in the management program reduced classroom management and non-academic activities in favor of learning activities. That is, the management program has caused non-academic activities to be replaced by learning activities. For each classroom activity (learning, non-academic, and classroom management activities), we regressed an equation with treatment as the independent variable. Specifically, our specification is defined as follows:

$$TActivity_{ijs} = \beta Treatment_s + X'_{is}\gamma + \varepsilon_{ijs} \quad (7)$$

Where: $TActivity_{ijs}$ is the average time of teacher's activity j , where $j = \{\text{learning, classroom management, non-academic activities}\}$, for student i at school s . To facilitate interpretation, we standardized the dependent

³⁶See [Bruns and Luque \(2014\)](#) and [WB \(2015\)](#) for more details.

variables around the mean and standard deviation of the control group. We report the results at [Table 5](#), column (4). Additionally, we present the average in the treatment and control groups, in columns (1) and (2), respectively, and the average difference, in column (3).

The results in column (4) suggest that the school management program caused a substitution effect on average teacher activity time, increasing learning activities by 0.57σ . Learning activities rose from 0.70 to 0.76 of total class time, representing a nearly 9% increment in learning activities. As a result, there has been a significant reduction in the time spent on non-learning activities, such as classroom management and non-academic activities. In summary, the school management program caused a substitution of teachers' practices in the classroom by increasing the instruction time and reducing non-learning activities.

To test our second hypothesis, we regress a logit model for the proportion of class time dedicated to learning activities on the indicator of the largest predicted heterogeneous treatment effect. We expect increased learning activities to be positively associated with a larger predicted treatment effect size. We present the results in [Table 6](#). The main specification includes student and school covariates similar to [Equation 1](#), and the standard error was estimated by school-level clustering. We observe that the variety of learning activities predicted the size of the predicted treatment effect. One standard deviation in learning activities represents a 0.34% increase in the probability that the student is in the highest treatment effect quartile group for self-management and 0.39% for open-mindedness.

In summary, our findings show that the school management program had the highest impact on self-management or open-mindedness in schools and significantly increased the proportion of class time devoted to learning activities. Its results are in line with recent literature showing the relevance of teacher practices to higher-order skills (or complex skills), such as [Kraft \(2019\)](#); [Blazar and Pollard \(2022\)](#); [Blazar and Kraft \(2017\)](#); [Fleche \(2017\)](#). Furthermore, it provides a possible mechanism for explaining how the incorporation of school management practices may influence social and emotional skills.

6 Concluding Remarks

This paper investigated the potential effect of improving school management on higher-order skills. In particular, by exploring a randomized trial in high schools in the Brazilian state of Ceará, we provide evidence that the quality of school management impacts two relevant social and emotional skills: self-management and

Table 5: Effect of the participation in the school management program on teacher's practices

Variables	Treatment (1)	Control (2)	Difference (3)	Treatment Effect (4)
Time spent in learning activities	0.772 (0.088)	0.703 (0.116)	0.069*** (0.001)	0.575*** (0.117)
Time spent in classroom management	0.174 (0.068)	0.213 (0.077)	-0.039*** (0.0007)	-0.490*** (0.125)
Time spent in non-academic activities	0.054 (0.041)	0.084 (0.066)	-0.030*** (0.0006)	-0.434*** (0.110)

Note: Table 5 presents, in column (4), the treatment effect of school participation in the management program on the time spent by teachers in each practice: learning activities, classroom management, and non-academic activities. Columns (1) and (2) show the time spent by teachers in treatment and control schools, respectively, for each practice. In column (3), we present the average difference between treatment and control schools. Robust standard errors are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

Table 6: The effect of average teacher practices on largest predicted treatment effect

Variables	Dependent variable: Self-management skill		
	(1)	(2)	(3)
Time spent in learning activities	0.334** (0.158)	0.338** (0.159)	0.346** (0.173)
Observations	34,298	34,298	34,298
School Controls	N	N	Y
Student Controls	N	Y	Y

Variables	Dependent variable: Open-mindedness skill		
	(1)	(2)	(3)
Time spent in learning activities	0.403*** (0.094)	0.400*** (0.095)	0.394*** (0.098)
Observations	34,298	34,298	34,298
School Controls	N	N	Y
Student Controls	N	Y	Y

Note: Table 6 presents the correlation of the time spent in learning activities on the largest predicted treatment effect. We included student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already reprovved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

open-mindedness. Self-management is related to the ability to focus attention and behavior on relevant things when we need to meet standards. In turn, open-mindedness is connected to curiosity, creativity, and tolerance for diversity. Consequently, open-mindedness is associated with unconventional thinking and creativity, allowing us to think differently and do things in new and better ways. Furthermore, the combination of these two skills, self-management and open-mindedness is associated with problem-solving and critical thinking.

In addition, we found evidence of heterogeneous effects on the impact of school management quality on social and emotional skills. Socially disadvantaged students are more positively impacted. This result suggests that the quality of school management can contribute to reducing deficits in social and emotional development among students caused by poverty.

Finally, we investigate whether the change in teachers' practices due to improved school management is correlated with the greater heterogeneous impact of the school management program. First, we show that the school management program caused a change in classroom practices by increasing teachers' time devoted to instruction, consequently reducing the time dedicated to non-academic activities. Following that, we find that increased classroom instructional time is significantly associated with the bigger impacts of the school management program on students' social and emotional skills. That is, schools that increased classroom instructional time the most had students experiencing the most heterogeneous impact.

In summary, improving the quality of school management is a key opportunity for education policy in developing countries. First, there are still large differences in terms of management quality between developed and developing countries. Second, management quality impacts not only cognitive skills but also social and emotional skills. Finally, specifically regarding social and emotional skills, the quality of school management can contribute to reducing inequalities in social and emotional skills.

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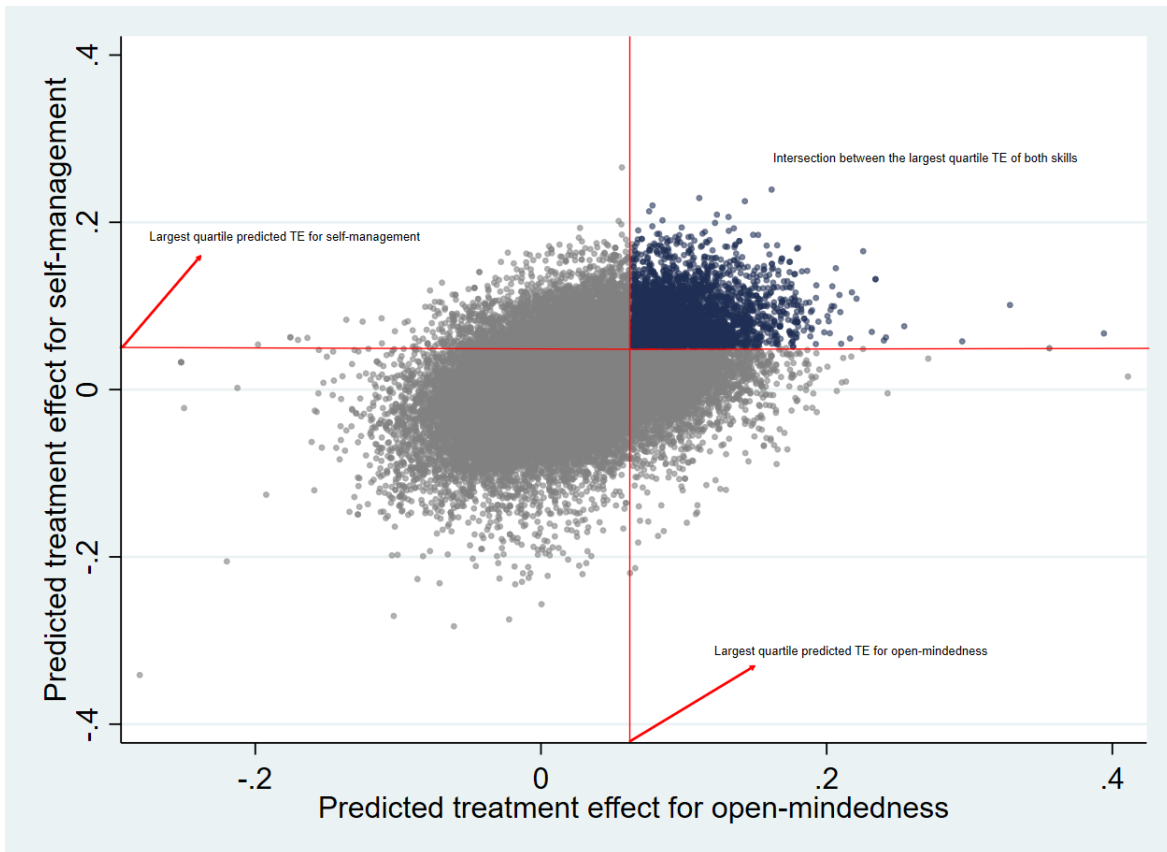
Appendix

Table A1: Balance check of pre-treatment variables at school level

School variables	N control	Mean control	N treated	Mean Treated	Diff
Adequacy of the teacher to learning	136	51.055	156	50.153	0.903
Average students per classroom	136	34.548	156	33.979	0.568
Average teacher turnover	129	3.189	141	3.135	0.054
Average school hours day	136	4.859	156	5.249	-0.391
Reproving rate	136	9.282	156	8.335	0.948
School dropout rate	136	11.909	156	10.196	1.713*
Average distortion age-grade	136	31.641	156	30.797	0.844
Average Portuguese Test-Score (2014)	136	263.808	156	268.296	-4.488
Average Math Test-Score (2014)	136	260.752	156	264.244	-3.492

Note: Table A1 presents the balance of pre-treatment variables at the school level. Specifically, we test average difference between school characteristics in treated and untreated schools. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure A1: Intersection between predicted treatment effect of both social and emotional skills



Note: Figure A1 presents the scatter plot of the predicted treatment effect for each student, estimated using the generalized random forest method, for self-management and open-mindedness skills. In the red line, we highlight the largest quartile of treatment effect for each social and emotional skill.

Table A2: Robustness check: Student Attention

Variables	Self-management (1)	Amity (2)	Engaging (3)	Emotional stability (4)	Open-mindedness (5)
Treatment	0.0255 (0.0198)	0.0198 (0.0227)	0.0199 (0.0176)	0.0148 (0.0155)	0.0353* (0.0198)
Treatment X Student's attention	0.0159 (0.0214)	-0.00164 (0.0212)	0.000304 (0.0199)	-0.0198 (0.0187)	0.00139 (0.0187)
Student's attention	0.226*** (0.0154)	0.411*** (0.0153)	0.204*** (0.0135)	0.113*** (0.0145)	0.0501*** (0.0155)
Observations	51,853	51,853	51,853	51,853	51,853
Student control	Yes	Yes	Yes	Yes	Yes
School control	Yes	Yes	Yes	Yes	Yes

Note: Table A2 presents the treatment heterogeneous effect of student attention in filling the questionnaire and school participation in the management program on the five social and emotional skills: Self-management, Open-mindedness, Regulation of Negative Emotions (also called Emotional Stability), amity, and Engagement with Others. We included, in all specifications, student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already improved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

Table A3: Robustness check: Without missing value imputation

Panel A	Dependent variable: self-management skill			
	(1) ITT	(2) ITT	(3) ITT	(4) ToT
Treatment	0.0400* (0.0213)	0.0379* (0.0204)	0.0343* (0.0188)	0.0379* (0.0206)
Observations	51,853	42,854	42,854	42,854
R-squared	0.000	0.025	0.030	0.030
Student control	No	Yes	Yes	Yes
School control	No	No	Yes	Yes
Panel B	Dependent variable: open-mindedness skill			
	(1) ITT	(2) ITT	(3) ITT	(4) ToT
Treatment	0.0303 (0.0200)	0.0360* (0.0195)	0.0376** (0.0180)	0.0415** (0.0198)
Observations	51,794	42,810	42,810	42,810
R-squared	0.000	0.010	0.015	0.015
Student control	No	Yes	Yes	Yes
School control	No	No	Yes	Yes

Note: Table A3 presents the treatment effect of school participation in the management program on the self-management and open-mindedness, without imputing values to correct for the presence of missing observation on covariates. For each social and emotional skill, we regressed the intention to treat (ITT) and the treatment-effects-on-treated (ToT), which used the random variable assigned to the program as the instrumental variable (IV) for teaching coordinator certification. We included student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already reprovved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

Table A4: Robustness check: Potential contamination from other programs - Self-management skill

Variables	Dependent variable: self-management skill					
	(1)	(2)	(3)	(4)	(5)	(6)
Social and emotional Program	-0.00918 (0.0226)	-0.00421 (0.0302)				
Treatment		0.0367* (0.0189)		0.0221 (0.0457)		0.0383** (0.0180)
Treatment x Social and emotional		-0.00117 (0.0458)				
<i>Jovem de Futuro</i> Program			-0.0602** (0.0247)	-0.0616 (0.0402)		
Treatment x <i>Jovem de Futuro</i>				0.0121 (0.0492)		
<i>Jovem de Futuro</i> Program (2015)					-0.0319 (0.0301)	-0.0141 (0.0287)
Treatment x <i>Jovem de Futuro</i> (2015)						-0.0358 (0.0733)
Observations	51,853	51,853	51,853	51,853	51,853	51,853
R-squared	0.038	0.039	0.039	0.039	0.039	0.039
School Controls	Y	Y	Y	Y	Y	Y
Student Controls	Y	Y	Y	Y	Y	Y

Note: Table A4 presents the heterogeneous treatment effect of school participation in others policies and school participation in the management program on the self-management skill. We consider three concomitant policies: social and emotional program, *Jovem de Futuro* program, and *Jovem de Futuro* program in wave 4. We included, in all specifications, student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already reproved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

Table A5: Robustness check: Potential contamination from other programs - Open-mindedness skill

Variables	Dependent variable: open-mindedness skill					
	(1)	(2)	(3)	(4)	(5)	(6)
social and emotional Program	0.00265 (0.0265)	0.0106 (0.0339)				
Treatment		0.0361* (0.0189)		0.0323 (0.0427)		0.0404** (0.0185)
Treatment x Social and emotional		-0.00951 (0.0555)				
Jovem de Futuro Program			-0.125*** (0.0258)	-0.115*** (0.0365)		
Treatment x Jovem de Futuro				-0.0117 (0.0461)		
Jovem de Futuro Program (2015)					-0.0400 (0.0255)	0.000161 (0.0340)
Treatment x Jovem de Futuro (2015)						-0.0979* (0.0499)
Observations	52,895	52,895	52,895	52,895	52,895	52,895
R-squared	0.016	0.016	0.018	0.018	0.016	0.016
School Controls	Y	Y	Y	Y	Y	Y
Student Controls	Y	Y	Y	Y	Y	Y

Note: Table A5 presents the heterogeneous treatment effect of school participation in others policies and school participation in the management program on the open-mindedness skill. We consider three concomitant policies: social and emotional program, *Jovem de Futuro* program, and *Jovem de Futuro* program in wave 4. We included, in all specifications, student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already reproved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

Table A6: Impact of school management improvement on additional student outcomes

Variables	(1) Student Absence	(2) Aspiration	(3) Do not study	(4) High school graduation	(5) Progression to 11th grade
Treatment	-0.081 (0.050)	0.103* (0.056)	-0.118 (0.072)	0.036 (0.047)	0.018 (0.051)
Observations	50,588	52997	52997	55,965	55,921
Pseudo R-squared	0.015	0.072	0.032	0.037	0.028
Student control	Yes	Yes	Yes	Yes	Yes
School Control	Yes	Yes	Yes	Yes	Yes
Model	Ordered logit	Logit	Logit	Logit	Logit

Note: Table A6 presents the treatment effect of school participation in the management program on five alternative outcomes: self-reported student absence in the last month, aspiration to enter higher education, self-reported information if a student does not study at home, student progression to next grade, and student graduation on the high-school. We included, in all specifications, student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already reprovved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A7: Robustness check: Inference

Variables	Self-management (1)	Amity (2)	Engaging (3)	Emotional stability (4)	Open-mindedness (5)
Treatment	0.036 (0.0174)	0.025 (0.0202)	0.012 (0.0141)	0.017 (0.0126)	0.033 (0.0168)
Boot. s.e.	0.0173	0.0203	0.0142	0.0124	0.0171
Romano-Wolf p-value	[0.002]	[0.025]	[0.112]	[0.025]	[0.003]
Rand. Inf. p-value	0.0400	0.2310	0.3730	0.1880	0.0570
Observations	51,853	51,853	51,853	51,853	51,853
Student control	Yes	Yes	Yes	Yes	Yes
School control	Yes	Yes	Yes	Yes	Yes

Note: Table A7 presents the treatment effect of school participation in the management program on the five social and emotional skills using alternative estimation of standard errors. First, we estimate the similar specification of Equation 1 using a bootstrap procedure, with 1000 bootstrap samples. In addition, we report the *p-value* estimated by Romano-Wolf's procedure that corrects for the problem of multiple testing. We included, in all specifications, student covariates (age, sex (girls), racial status (black and brown), a binary variable indicating whether the family participates in the federal government cash transfer program, and a binary indicator if the student has already improved during his or her school path) and school controls (average class size and the average rate of students in the inappropriate age for grade 10 (also called age distortion)). Robust standard errors, estimated by school-level clustering, are reported in parentheses. Significance levels *** p<0.01, ** p<0.05, * p<0.1

Online Appendix

Effect of school management improvements on the students social and emotional skills: Experimental evidence from Brazil

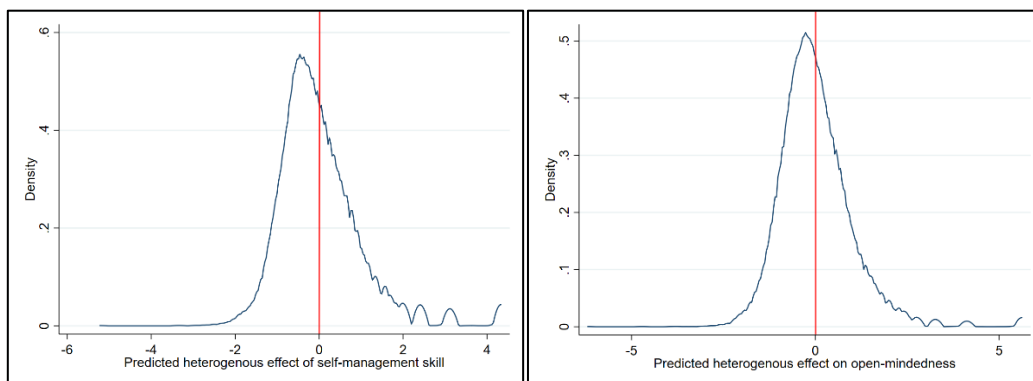
1. Causal Forest

1.1 Implementation details

We estimate the causal forest using a set of pre-determinate variables. The causal forest procedure requires the absence of missing observation, then our sample had 34298 students. Table B5, in this appendix, shows that treatment assignment is not correlated with the presence of missing observation. Then, we expected that the sample was representative and balanced.

The figure A1 shows the density of predicted treatment effect on both self-management (A) and open-mindedness skill. The distribution is fairly symmetric and bell-shaped, which contributed to our use a high-quartile to test heterogeneity differences in treatment effect.

FIGURE A1: Density of predicted treatment effect for both social and emotional skills



Note: Figure A1 demonstrates the density distribution of the predicted treatment effect on a standardized measure of self-management and open-mindedness social and emotional skills.

1.2 Variables used in the Causal Forest

To implement causal forest, we use the following variables:

- Demographic: Age in years, gender, and racial status: white, black and brown;
- Parents support: Lives with mother, lives with father, study alone, parents help to study;
- Mother education: Binary variables indicating mother educational level
- Prior education: attended preschool, kindergarten, primary school, reprovved
- Socioeconomic status: family attended Federal Cash-transfer program (Bolsa Família), number of members in family, distance (in time) to school, socioeconomic index (SES).

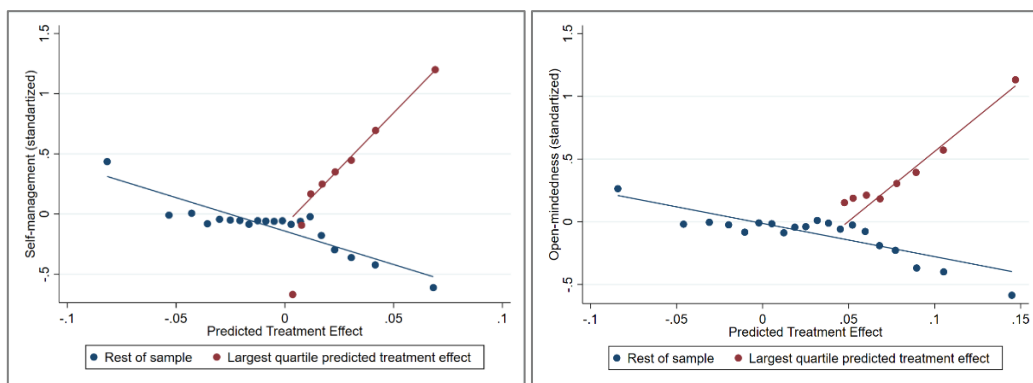
The socioeconomic index was estimated using Principal Components Analysis (PCA) based on students self-reported assets: computer, microwave, tv, car, refrigerator, washing machine, there is a maid working at home, the street of the home is paved, has electricity at home, has piped water at home, the street has public garbage collection.

1.3 Validated of quartile analysis

We note some aspects to decided performs the heterogenous treatment effect analysis using quartile differences. First, Table B2 shows that the higher-quartile is strongly predictive of treatment effect in both social and emotional skills. It suggests that higher-quartile of predicted treatment effect really identify the presence of heterogenous treatment effect and also contribute to reduced predictive errors.

To inspect this assumption visually, we plot a binscatter of the two groups (largest predicted treatment effect and rest of the sample) for both social and emotional skills. The figure A2 indicates that the higher the value of the predicted treatment effect, the larger the value of both social and emotional skills for the group in the highest quartile. However, for the rest of the sample, the higher the predicted treatment effect value the lower the value of both social and emotional measures. In other words, the largest predicted treatment effect group is strongly and positively correlated with social-emotional skills. However, the rest of the sample is not correlated with social-emotional skills.

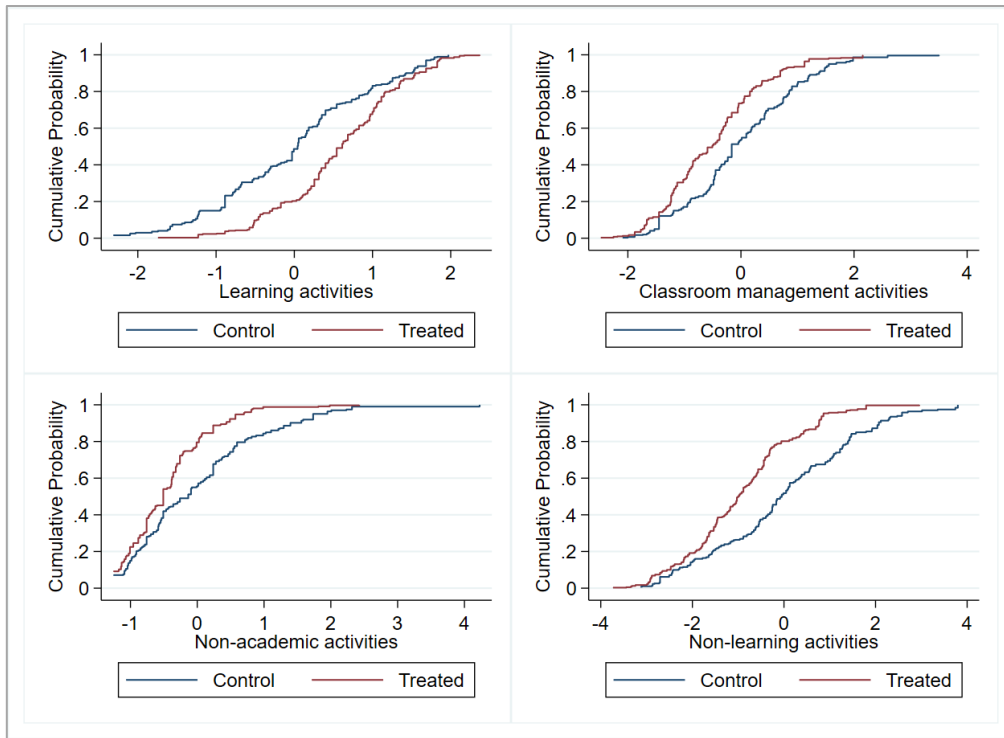
FIGURE A2: Binscatter plots of the largest quartile predicted treatment effect and the rest of the sample on the social and emotional skills



Note: Figure A2 demonstrates binscatter plots of the largest quartile predicted treatment effect and the rest of the sample on a standardized measure of self-management and open-mindedness social and emotional skills. In both cases, the quartile predicted treatment effect is correlated with social and emotional skills, while the rest of the sample is not.

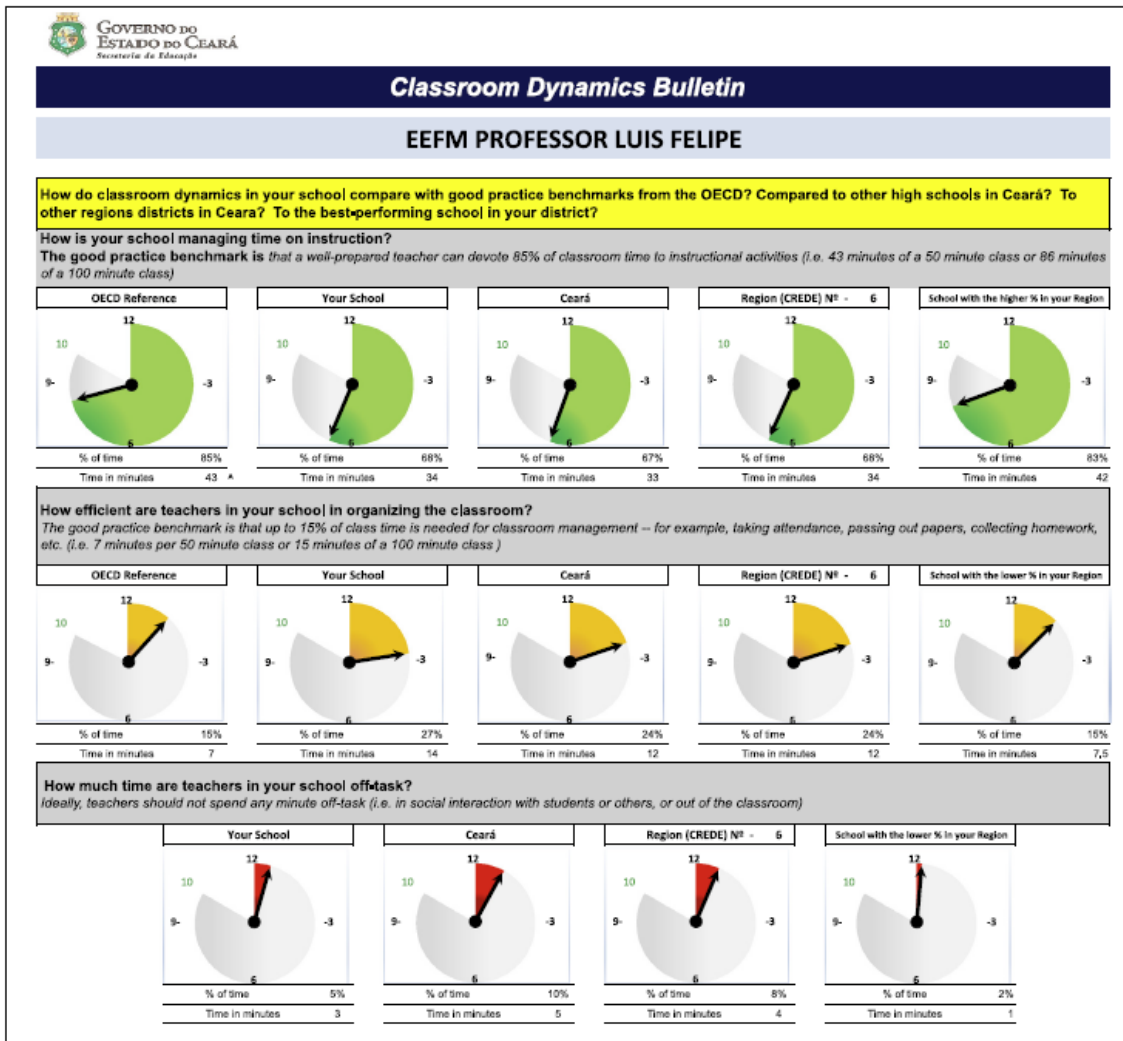
2. Additional figures

FIGURE A3: Cumulative distributions of teachers' practices on treated and control schools



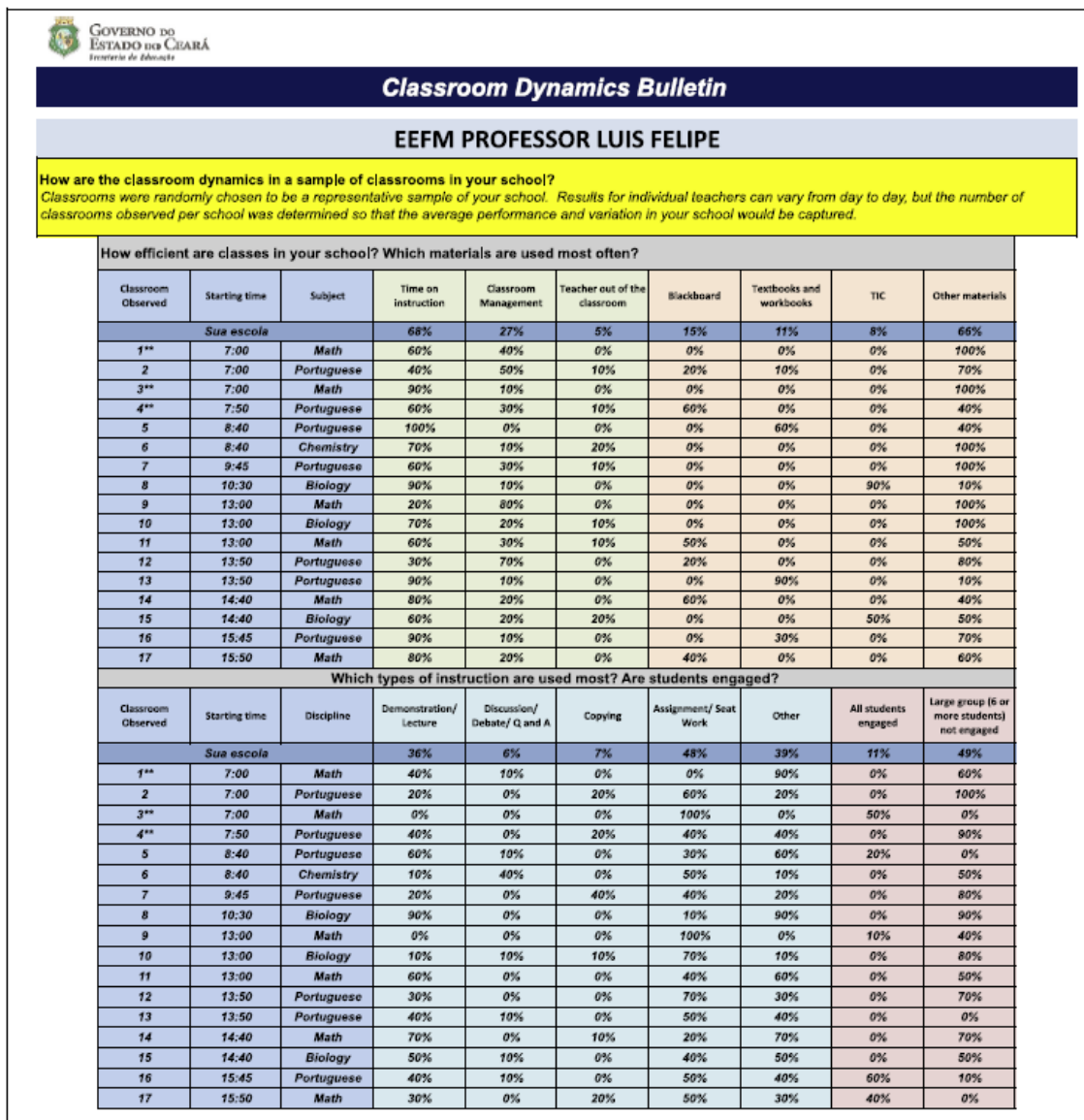
Note: Figure A3 shows the cumulative distributions of teacher practice measures on treated and control schools. Program implementers use Stalling's classroom observation method to evaluate teachers' practices in the classroom. We consider four variables related to teachers' classroom practices: the proportion of teachers' average total class time devoted to learning activities (Learning Activities), the proportion of teachers' average time devoted to classroom management (Classroom management), the proportion of teachers' average time devoted to non-academic activities (Non-academic activities), and the sum of the non-academic activities and classroom management (Non-learning activities).

Figure A4: Infographic Classroom Bulletin Example



Note: Figure A4 shows an example of infographic classroom bulletin used to inform teachers about their practices. Source: Bruns et al. (2018).

Figure A5: Classroom Bulletin Example



Note: Figure A5 shows an example of infographic classroom bulletin used to inform teachers about their practices. Source: Bruns et al. (2018).

3. Additional tables

Table B1: Overlap between schools participating and not participating in the school management program

Student variables	Treated		Control		Balance Std-diff
	Mean	Variance	Mean	Variance	
Age	9.730	2.179	9.746	2.244	-0.011
Girl	0.530	0.249	0.526	0.249	0.008
White	0.198	0.159	0.199	0.160	-0.002
Brown	0.568	0.245	0.570	0.245	-0.005
Black	0.069	0.064	0.067	0.063	0.007
Other racial status	0.152	0.129	0.150	0.128	0.007
Lived with both parents	0.359	0.230	0.351	0.228	0.015
Parents help to study	0.289	0.205	0.299	0.210	-0.023
Mother education: Never Studied	0.155	0.131	0.171	0.142	-0.044
Mother education: Primary Ed.	0.147	0.126	0.166	0.138	-0.051
Mother education: Middle Ed.	0.253	0.189	0.250	0.187	0.009
Mother education: Secondary Ed.	0.180	0.148	0.169	0.140	0.029
Mother education: Tertiary Ed.	0.040	0.039	0.038	0.036	0.013
Reproved	0.279	0.201	0.284	0.203	-0.011
Pre-School	2.153	0.779	2.081	0.669	0.085
Distance to school	1.764	0.765	1.779	0.774	-0.017
Cash transfer program	1.407	0.241	1.394	0.239	0.025
Number of people in family	3.850	3.148	3.909	3.293	-0.032

Note: Table B1 depicts the difference in overlap between schools that participate and do not participate in the school management program using normalized (or standardized) differences. Rubin (2001). (2001). According to Imbens and Wooldridge (2009), the normalized difference should be less than 0.25 in order to consider the sample balanced. We find no covariate with a normalized difference greater than 0.25, implying that schools that participated in the school management program are comparable to schools that did not participate.

TABLE B2: Heterogeneity treatment effect by predicted treatment impact

Panel A	Dependent variable: self-management skill		
	(1)	(2)	(3)
Treatment x Largest Quartile	1.271*** (0.0432)	1.264*** (0.0412)	1.271*** (0.0401)
Treatment	-0.300*** (0.0227)	-0.299*** (0.0210)	-0.306*** (0.0183)
Largest Quartile	-0.556*** (0.0292)	-0.538*** (0.0268)	-0.542*** (0.0258)
Observations	34,298	33,943	33,943
R-squared	0.081	0.106	0.113
School Controls	N	N	Y
Student Controls	N	Y	Y
Panel B	Dependent variable: open-mindedness skill		
	(1)	(2)	(3)
Treatment x Largest Quartile	0.564*** (0.0348)	0.566*** (0.0349)	0.561*** (0.0344)
Treatment	-0.112*** (0.0233)	-0.115*** (0.0220)	-0.115*** (0.0207)
Largest Quartile	-0.250*** (0.0292)	-0.270*** (0.0268)	-0.264*** (0.0258)
Observations	34,298	34,298	34,298
R-squared	0.016	0.027	0.031
School Controls	N	N	Y
Student Controls	N	Y	Y

Note: Table B2 shows the estimation of the interaction of treatment and the largest quartile predicted treatment effect for both, self-management and open-mindedness skills. We vary the specification by including student and school controls. The interaction between the indicator of the largest predicted treatment effect with schools participating in the program has a larger differential effect on self-management, suggesting that this group has a heterogeneous positive effect relative to the rest of the sample.

Table B3: Descriptive Statistics

Student variables	Obs	Mean	Std. Dev.	Min	Max
Demographic factors					
Age	50545	15.91	1.73	7	20
Girl	51896	0.50	0.50	0	1
White	51896	0.20	0.40	0	1
Brown	51896	0.56	0.50	0	1
Black	51896	0.07	0.25	0	1
Other racial status	51896	0.15	0.36	0	1
Parents factors					
Lived with both parents	51896	0.33	0.47	0	1
Parents help to study	51896	0.30	0.46	0	1
Mother education: Never Studied	48725	0.17	0.37	0	1
Mother education: Primary Education	48725	0.19	0.39	0	1
Mother education: Middle Education	48725	0.25	0.43	0	1
Mother education: Secondary Education	48725	0.16	0.37	0	1
Mother education: Tertiary Education or higher	48725	0.04	0.19	0	1
Prior education					
Reproved	44,550	0.31	0.46	0	1
Pre-School	50,413	2.05	0.81	1	4
Socioeconomic status					
Distance to school (hours)	50,985	1.82	0.89	1	4
Cash transfer program	50,834	1.39	0.49	1	2
Number of people in family	48,219	3.90	1.84	1	10

Note: Table B3 shows the summary statistics to the students. We separate the set of variables in four groups: Demographic factors, Parent factors, Prior education and Socioeconomic status.

Table B4: First Stage

Variable	Treatment
Certificated	0.907*** (0.023)
F - Statistic	287.22
Observations	52,954
Adj. R-squared	0.837
Student control	Yes
School control	Yes

Note: Table B4 shows the first stage treatment on the probability of a teaching coordinator receiving a certificate. The estimates show that school treatment is highly predictive of certification.

Table B5: Treatment status on missing indicator

Variable	Missing
Treatment	0.018 (0.060)
p-value	[0.764]
Method	Logit
Pseudo-R2	0.000
Observations	51,896

Note: Table B5 shows the treatment estimation in the presence of missing covariates. We estimate a logit model with the missing indicator as the dependent variable. The findings indicate that missing values in covariates are not related to school treatment.

4. Definition of variables

Social and emotional skill	Definition	Facets
Self-management	Self-management skills refer to the abilities and techniques that an individual can use to effectively manage their own behavior, emotions, and time in order to achieve personal and professional goals.	Determination; Organization; Focus; Persistence
Amity	Agreeableness is a social and emotional skill that refers to an individual's tendency to be cooperative, considerate, and empathetic towards others.	Compassion, Respect, Trust
Engaging with others	Engaging with other is the ability to effectively connect and interact with people in social settings. This skill includes being able to communicate clearly and listen actively, as well as demonstrating empathy, respect, and cultural sensitivity towards others. Individuals who possess strong engaging with others skills tend to be friendly, approachable, and skilled at building rapport with others.	Social Initiative, assertiveness, Enthusiasm
Emotional stability	Emotional stability is a social and emotional skill that refers to an individual's ability to maintain a stable and consistent emotional state, even in the face of stress, adversity, or challenging situations. People who possess emotional stability are typically resilient, adaptable, and able to regulate their emotions effectively. They are less likely to be overwhelmed by negative emotions such as anxiety, anger, or sadness, and more likely to maintain a positive outlook even when faced with difficult circumstances.	Stress modulation, Self-confidence. Frustration tolerance
Open-mindedness	Open-mindedness is a social and emotional skill that involves being receptive to new ideas, perspectives, and experiences. It involves being willing to consider alternative viewpoints, and being able to challenge one's own assumptions and biases. Individuals who possess open-mindedness as a social and emotional skill tend to be curious, reflective, and adaptable. They are often more creative and innovative in their thinking, and more able to collaborate effectively with people from diverse backgrounds.	Curiosity to learn, Creative imagination, artistic interest