The Causal Impact of Socio-Emotional Skills Training on Educational Success*

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Abstract

We study the long-term effects of a randomized intervention targeting children's socio-emotional skills. The classroom-based intervention for primary school children has positive impacts that persist for over a decade. Treated children become more likely to complete academic high school and enroll in university. Two mechanisms drive these results. Treated children show fewer ADHD symptoms: they are less impulsive and less disruptive. They also attain higher grades, but they do not score higher on standardized tests. The long-term effects on educational attainment thus appear to be driven by changes in socio-emotional skills rather than cognitive skills.

Keywords: Socio-emotional skills, randomized intervention, child development, school tracking
JEL classification: C93, I21, I24, I26, J24

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1. Introduction

Socio-emotional skills are predictive of major life outcomes like educational attainment, employment, earnings, health, and participation in crime (Heckman and Rubinstein 2001; Roberts et al. 2007; Almlund et al. 2011). While the predictive power of socio-emotional skills has been established, there is an ongoing debate about how malleable these skills are. If these skills are indeed malleable, interventions targeting children's socio-emotional skills may change the trajectory of a life and lead to lasting changes in educational attainment and labor market outcomes.

In this paper, we study how a randomized intervention among eight-year-old children in Switzerland affects tracking, high school completion, and university enrollment. The Promoting Alternative Thinking Strategies (PATHS) intervention is a classroom-based socio-emotional learning program for elementary school students that aims to reduce behavioral problems (Greenberg et al. 1995). The intervention consists of weekly lessons and homework assignments embedded in the school curriculum. PATHS lasts for up to two years and is designed to foster self-control, patience, social problem-solving skills, self-esteem, emotional intelligence, and academic engagement.

PATHS teaches children to think twice and to look ahead. For example, in one classroom exercise, children learn to make less impulsive choices in difficult situations with the three-part "stoplight approach." First, on the red light, children slow down, take a few deep breaths and explain the problem they face. Next, on the yellow light, children think about solution options, consequences of their actions, and plan a solution to the problem. Finally, on the green light, children execute their plan and evaluate whether it worked. Teachers support children in applying the stoplight approach in role-play and real-life situations occurring in class such as a conflict with peers. Children also practice this approach in homework assignments: they describe a school-related social or academic problem, explain solution strategies to parents or classmates, and collect feedback on their solution strategies. PATHS includes elements of cognitive behavioral therapy and targets problem-solving and regulatory skills that have been associated with improved externalizing behavior conducive to learning, achievement, and future school success (Izard et al. 2004; Fantuzzo et al. 2007; Roberts et al. 2007; Raver et al. 2011; Deming 2017).

The PATHS intervention was implemented in 2005 in the city of Zurich in Switzerland. Its main goal was to reduce disruptive and aggressive behavior by improving children's socio-emotional skills (Eisner, Malti, and Ribeaud 2012).[1] PATHS was introduced in 28 out of 56 randomly selected public primary schools. Randomization took place at the school level and

[1] See Eisner et al. (2012), and Malti, Ribeaud, and Eisner (2012), and Averdijk et al. (2016), for a more detailed description.

was stratified within school districts. The intervention was supposed to last for one school year in second grade; however, the program was so popular that over 70 percent of schools accepted the offer to continue with the program for a second year. The experimental design also included the Triple P parenting training program, which was implemented in half of the schools in the PATHS treatment schools and in half of the control group schools. The Triple P intervention, in contrast to PATHS, was less intensive and parents received on average less than two hours of intervention time. Triple P did not affect educational outcomes. In this paper we focus on the PATHS intervention and, for completeness, discusses the additional intervention and evaluation results in Appendix Section A3.

To evaluate the long-term effects of the PATHS intervention, we follow the treatment and control group over 15 years using the Zurich Project on Social Development from Childhood to Adulthood (z-proso) panel. This panel surveys children, teachers, and primary caregivers on an annual or biannual basis from 2004 until 2018, with the last wave interviewing children at age 20. The data include baseline and follow-up measures of children's socio-emotional skills, parenting practices, family and household characteristics, as well as administrative and self-reported educational outcomes. The combination of multi-respondent survey data matched to administrative education records allows us to provide detailed evidence on how treatment effects evolve over time and what skills the intervention affects.

PATHS has lasting effects on educational careers. At age 13, four years after the intervention, treated children become 4.4 percentage points more likely to get tracked into academic high school (Gymnasium).[2] The treatment effect persists, and these children become 7.1 percentage points more likely to complete academic high school. This effect is economically significant. It represents a 23 percent increase relative to the mean of the control group. At age 20, twelve years after the intervention, the treatment group is 4 percentage points more likely to attend university, a 21 percent increase relative to the control group.

How does PATHS's effectiveness compare to iconic childhood intervention programs? The size of the PATHS treatment effect is one-seventh of the treatment effect of the Abecedarian program for college attendance (Campbell et al. 2014) and one-quarter of the size of the Perry Preschool Program for high school completion (Schweinhart 1993, Heckman et al. 2010a). Our effect size on academic high school attendance is very similar to the treatment effect of the Baloo and You mentoring program (Falk, Kosse, and Pinger 2020).

[2] Ability tracking into secondary school represents a key educational transition in Switzerland. Academic high school (*Gymnasium*) is the highest secondary school track in Switzerland. Enrollment in university requires a degree from an academic high school. Over 62 percent of OECD countries use a similar school-based tracking system (OECD 2004). Tracking in Switzerland is not a choice outcome of parents or children and is not determined by subjective teacher recommendations. Tracking is determined by two student performance measures: (1) grades in core subjects in the last grade of primary school, and (2) standardized externally evaluated admission test scores.

To investigate how the PATHS intervention affected children's educational attainment, we study four potential mechanisms. We evaluate changes in: (1) grades and test scores, (2) socio-emotional skills, (3) children's classroom behavior, and (4) parenting practices. We find evidence for the first three mechanisms. First, the intervention increases students' teacher-assessed grades, but it has *no* impact on academic high school admission test scores. As grades are more influenced by socio-emotional skills and classroom behavior than achievement tests (Borghans et al. 2016), our results suggest that the treatment effect is more likely to operate through changes in socio-emotional skills rather than through improved cognitive skills. Second, treated children display less attention deficit and hyperactivity disorder (ADHD) symptoms: they are less impulsive and less disruptive. Treated children also display less opposition, defiance, and non-aggressive conduct disorders. Children's anxiety, physical aggression, and prosociality are not affected by the intervention. Third, treated children are less likely to disturb lessons and more likely to focus on the teaching content in class. We do not find that treated children become more likely to complete their homework assignments, which suggests that the treatment mostly affects engagement and attention in the classroom. Fourth, we find little treatment effects on parenting practices.

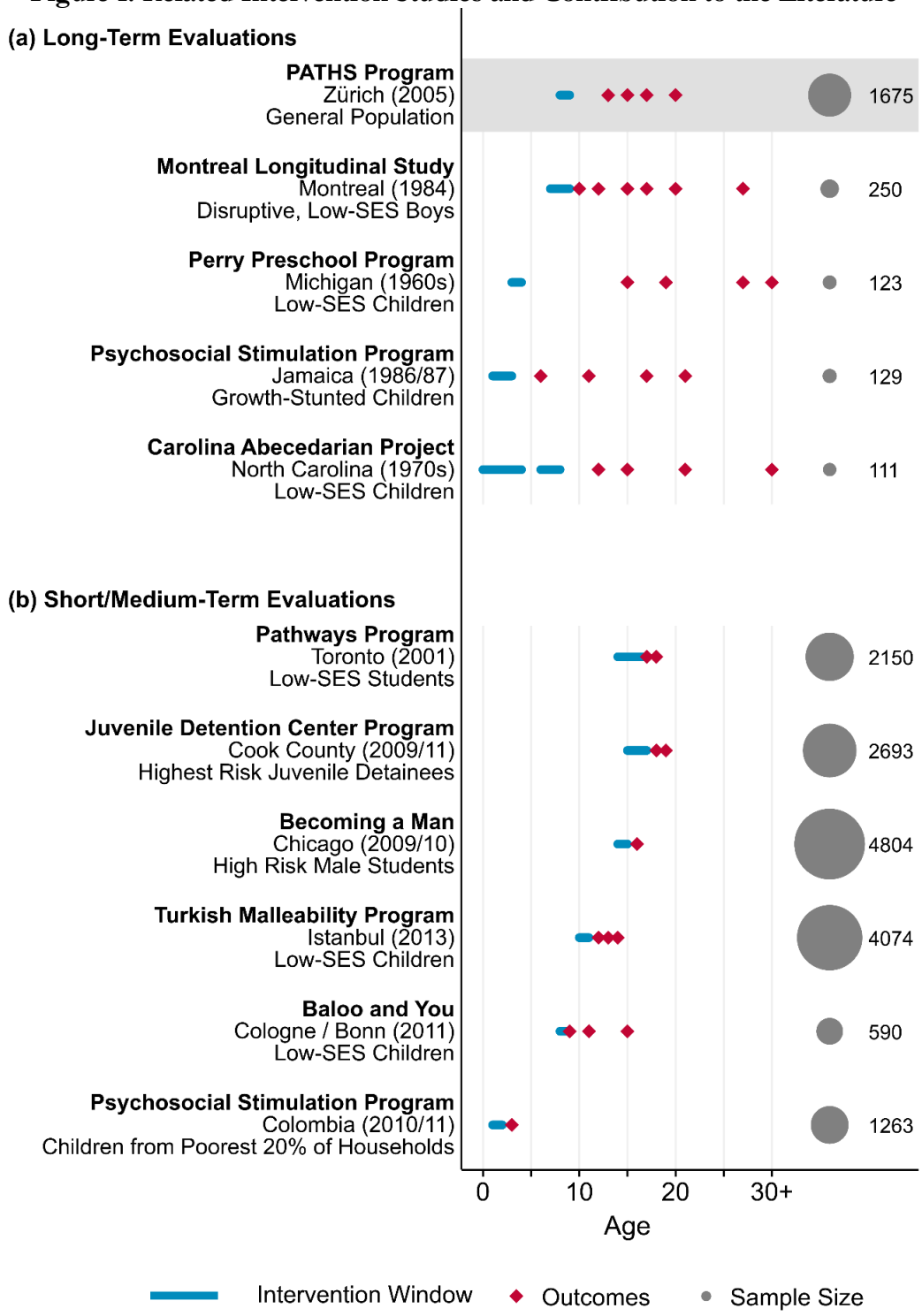
Taken together, our analysis of the underlying mechanisms paints a consistent picture. The PATHS program reduces children's impulsiveness and fosters their decision-making process. These behavioral changes improve classroom behavior, which is rewarded by higher grades. In the long run, these improvements in grades lead students to enter the academic high school track and enroll in university.

This paper contributes to the literature by connecting studies on long-term effects of childhood interventions to recent evidence on the malleability of socio-emotional skills.[3] Although a number of existing studies hypothesize that the long-term impact of early childhood interventions are due to changes in socio-emotional skills, the direct empirical evidence for this link is limited. This paper fills that gap.

Figure 1 summarizes related intervention studies and our contribution to this literature. Panel (a) shows childhood intervention programs with long-term evaluations: Campbell et al. (2002) evaluate the Abecedarian preschool program, one of the oldest early childhood interventions, and show that the intervention improved IQ, achievement, and college enrollment.

[3] Durlak et al. (2011), Taylor et al. (2017), and Blewitt et al. (2018) conduct a meta-analyses of school-based programs to promote students' social and emotional development and conclude that these programs are generally effective. Socio-emotional learning programs are associated with improved attitudes about the self and others, increased prosocial behavior, lower levels of problem behaviors and emotional distress, and improved academic performance.

Figure 1: Related Intervention Studies and Contribution to the Literature



NOTE.—This figure provides an overview of intervention studies in the related literature. Panel (a) shows intervention programs with long-term evaluations. Panel (b) shows programs with short- and medium-term evaluations of interventions targeting socio-emotional skills. Horizontal bars indicate the intervention duration. Red diamonds indicate when post-treatment measures are observed. Sample size refers to the number of students effectively randomized into treatment or control status. "SES" stands for socio-economic status. Information on the Montreal Longitudinal Study is taken from Algan et al. (2016). Information on the Perry Preschool Program is reported in Heckman et al. (2010a,b). Information on the Jamaican Psychosocial Stimulation Program is taken from Gertler et al. (2014). Information on the Carolina Abecedarian Project is reported in Campbell et al. (2014), Information for the Juvenile Detention Center intervention and the Becoming a Man program is reported in Heller et al. (2017). Information for the Pathways program is reported in Oreopoulos, Brown, and Lavecchia (2017). The Turkish Malleability Program refers to the randomized control trials analyzed in Alan and Ertac (2018) and Alan et al. (2019). Sample size and invention periods for the Baloo and You program are taken from Kosse et al. (2020) and Falk et al. (2020).

Heckman et al. (2010a) and Schweinhart (1993) evaluate the Perry Preschool Program, which aimed to foster the development of disadvantaged children, and show that program participants obtained more schooling, had higher earnings, and committed fewer crimes.[4] Gertler et al. (2014) analyze long-term effects of the Jamaican Study that contained an intervention aimed at improving mother-child interactions through home visits. They find increases of 25 percent in earnings 20 years after the intervention. Algan et al. (2016) use data from the Montreal Longitudinal Experimental Study, which aimed to improve socio-emotional skills in boys with after-school training sessions. This intervention increased self-control and trust during adolescence and increased educational achievements in early adulthood.

Panel (b) in Figure 1 summarizes more recent interventions explicitly targeting socio-emotional skills in children. Alan, Boneva, and Ertac (2019) show that an intervention targeting grit increases students' perseverance and subsequent math test scores two years after the intervention. Alan and Ertac (2018) show that an intervention targeting patience improves self-control and the ability to imagine future selves. These effects lead to more patient intertemporal choices and persist over a three-year period. Cappelen et al. (2020) show that early childhood education affects children's social preferences for fairness and the importance children place on efficiency relative to fairness.

Oreopoulos, Brown, and Lavecchia (2017) evaluate a mentoring and tutoring program and find that the program increases high school completion by 35 percent and postsecondary enrollment by more than 60 percent. Kosse et al. (2020) study a mentoring program for primary school children and show that the program persistently increases prosociality. Falk et al. (2020) follow these children over time and show that the program also increases the probability of attending the academic high school track. Heller et al. (2017) evaluate an intervention in Chicago similar to PATHS called "Becoming a Man" (BAM). Both programs target emotional awareness, emotion regulation, and behavioral change in the decision-making process of students.[5]

We contribute to the literature in four ways. First, we observe children over a decade after the intervention. This distinguishes us from studies focusing on interventions

[4] Heckman and Karapakula (2019a and 2019b) follow up on these results and highlight positive long-term effects on cognitive skills, employment, health, and reduced crime, as well as positive intergenerational spillovers.

[5] Both interventions were originally implemented to reduce future aggression and delinquency. The PATHS intervention shows, in contrast to Heller et al. (2017), no impact on aggression and delinquency (Averdijk et al. 2016). This may be due to different environments in Chicago and Zurich. In 2017, for example, the Chicago homicide rate was 28 times higher and the assault rate 48 times higher than in Zurich.

targeting socio-emotional skills, which are limited to outcomes observed a few years after the intervention. Second, in contrast to studies evaluating the long-term consequences of other childhood interventions, we have a substantially larger sample. With 1,675 individuals, we have more statistical power than the Abecedarian Program (n = 111), the Perry Preschool Program (n = 123), the Jamaican Study (n = 129) and the Montreal Longitudinal Study (n = 250). Third, while other studies almost exclusively focus on disadvantaged children, we evaluate an intervention that targets children of all backgrounds. Fourth, our detailed survey data allow us to provide evidence on the underlying mechanisms showing which skills and behaviors are affected by the intervention.

2. The PATHS Training Program

PATHS is a teacher-led program for primary school children that was developed by Mark T. Greenberg and Carol A. Kusché at the University of Washington for the US context (Kusché and Greenberg 1994). The program teaches systematic coping and decision-making strategies with the aim of fostering children's self-control, emotional understanding, and social problem solving skills (Greenberg et al. 1995).

PATHS focuses on regulatory skills; it aims to foster social skills and improve externalizing behavior (Greenberg et al. 1995, 1998). These behavior changes should improve educational participation, reduce disruptive and aggressive behavior in the classroom, and, ultimately, reduce violence, delinquency, and crime. Table A1 in the Appendix, provides an overview of the PATHS curriculum, which targets the following competences:[6]

(1) Self-control, patience

(2) Decision-making strategies, social problem solving

(3) Self-esteem

(4) Emotional intelligence

(5) Fairness and rules

(1) Self-control, patience: PATHS targets self-control and patience through several exercises. Children learn to calm down in stressful situations using breathing techniques. They learn

[6] Figures A1–A4 in the Appendix provide examples of the teaching material related to the activities summarized in Table A1.

that it is their own responsibility to avoid exploding in anger and losing self-control through the analogy of a balloon that can burst. They role-play situations in which they practice ignoring, interpreting, and handling teasing of other children. They listen to a story of a girl who learned how to control herself by calming down and recognizing her emotions. The children complete some of these exercises at home. For example, children interview their parents about situations in which they had to calm down and write a summary of how their parents managed the situation.

(2) Decision-making strategies, social problem solving: PATHS targets decision-making strategies and social problem solving based on the stoplight approach. To introduce the stoplight approach, the teacher uses the stoplight poster shown in Figure A1 in the Appendix. This approach teaches children systematic decision-making by going through three mental steps before taking action. Each step represents one of phases of the stoplight. The red-light phase is associated with the word "stop." In this phase, children must slow down, take a few deep breaths, and explain the problem they are facing. The yellow-light phase is associated with the word "think." In this phase, children reflect on their solution options, think about the possible consequences of their actions, and make a plan to solve the issue. They also think about how others will respond to their actions. The green-light phase is associated with the word "act." In this phase, children execute their plan and evaluate whether it worked.

After introducing the method in class, the teacher discusses concrete situations in which children can use the approach. Children then apply the stoplight approach in repeated role-play exercises that simulate everyday situations. These exercises involve conflict situations with peers, parents, or teachers, or problems with school assignments. In homework assignments, children describe their problem-solving approach to a specific situation. They also practice the approach at home and explain the three steps to their parents, who receive a separate information leaflet about the benefits of the stoplight approach (Figure A5).

(3) Self-esteem: PATHS aims to increase children's self-esteem by making them aware of their strengths and skills. In one of the lessons, children learn to give and accept compliments from peers and teachers. The teacher explains the concepts of compliments and respect as well as how to express compliments. Children then practice how to give

compliments to each other in the classroom. In one homework assignment, children exchange compliments with parents and other family members at home.

In another exercise, the "child of the week" receives special privileges and duties for one week. As part of this exercise, the child acts as the teacher's assistant. At the end of the week, the teacher and classmates prepare a special child-of-the-week certificate with a picture of the child and a series of compliments and anecdotes describing what attributes classmates value in the child. While this activity is supposed to foster self-esteem, it also teaches children that privilege comes with responsibilities. They are supposed to learn that being valued by others also requires contributing to the common good.

(4) Emotional intelligence: PATHS targets emotional intelligence by fostering the understanding and expression of feelings. In one lesson, the teacher reads stories and children guess what feelings the protagonist felt. In one homework assignment, children describe their feelings during a recent emotional situation and discuss with their parents how they dealt with their emotions. With this exercise, children learn about themselves and become more aware of how their behavior affects the feelings and perceptions of peers, parents, and teachers. To facilitate the recognition and expression of feelings, children receive "feelings cards." These cards show children expressing different emotions such as happiness, excitement, anger, surprise, sadness, and worry (see Figure A2 in the Appendix). Children first color these cards and then use them to express their current emotional state by placing the corresponding card on their table. In a final step, children reflect on how to demonstrate an emotion. For example, they have to find appropriate verbal responses to feelings like anger or sadness.

(5) Fairness and rules: Starting with the first PATHS lesson, children discuss the importance of having rules and manners. They discuss with their teachers in class and parents at home which rules should be established in the classroom, at home, and in general everyday life. PATHS also tries to foster children's understanding of fairness by introducing children to principles of fair behavior. In one lesson, children have to identify fair and unfair behavior in different situations. In another lesson, the teacher reads a story and the children discuss whether the protagonists' behavior is fair or unfair.

3. Data and Institutional Background

This section provides the institutional background of this study. First, we introduce the Zurich Project on Social Development from Childhood to Adulthood (z-proso data collection). Second, we illustrate the main characteristics of the education system in the Canton of Zurich.

3.1 The z-proso Study

The data we analyze in the paper come from the z-proso panel study (Malti, Ribeaud, and Eisner 2011; Eisner et al. 2012; Averdijk et al. 2016). Ribeaud et al. (2022) provide a detailed description of the Zurich Project on the Social Development from Childhood to Adulthood (z-proso). The study surveys students, teachers, and primary caregivers[7] to investigate the life-course of 1,675 children starting primary school in 2004 in Zurich, the largest city in Switzerland. Table A2 in the Appendix provides an overview of the timing of the surveys, the respondents, and the response rate in eight different waves that took place between 2004 and 2018. By 2018, the study had followed children over a 15-year period until they were 20 years old. Throughout the eight interview waves response rates remain high. At age 20, for example, over 70 percent of the original sample respond to the survey.

The z-proso data include pre-intervention (baseline) and follow-up measures of children's socio-emotional skills, parenting practices, family and household characteristics, and administrative and self-reported educational outcomes. Appendix Section A2 describes the data collection, informed consent, and ethics approval in greater detail.

Two early prevention programs were implemented as part of the z-proso study. The first intervention was PATHS, the school-based social and emotional learning-based program we focus on in this paper (see Section 2). The second intervention was the "Positive Parenting Program" (Triple P). Triple P encourages "positive parenting" by teaching techniques that support desired child behavior, routines that avoid parent-child conflicts, and techniques that help the child plan ahead (Sanders 1999). In this paper, we focus on the PATHS intervention. For completeness, we provide more details on the Triple P intervention in Section 4 and show its treatment effects in Sections 6 and Appendix Section A3.

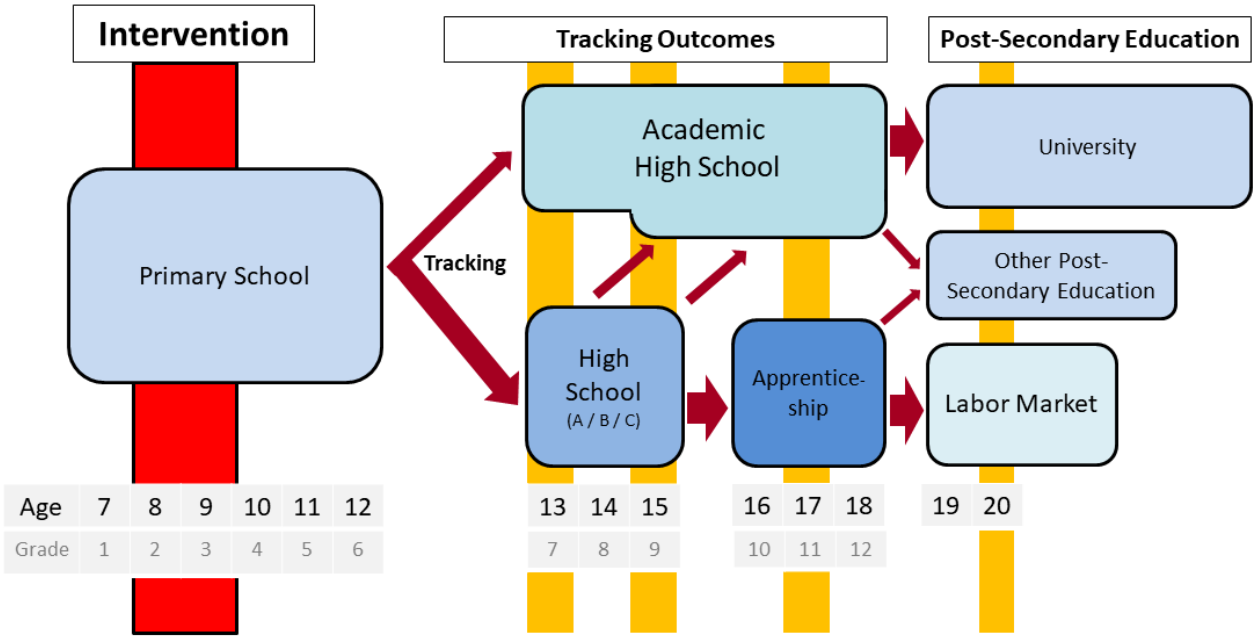
[7] In most cases the primary caregiver is a child's biological parent. Throughout the paper we use the terms primary caregiver and parents interchangeably.

3.2 Education and Tracking System

Figure 2 illustrates the school system and educational transitions in the canton of Zurich. Children start primary school at age seven. At age 12, after six years of primary school, children are tracked into different secondary schools.

The highest school track is academic high school (*Gymnasium*). Students attend this school for six years and typically graduate when they are 18 years old. It prepares students for university education and allows them to obtain the *Matura* degree required to enroll in university. Children in the lower track attend one of three secondary high schools called *Sekundarschule* level A, B, and C. These schools prepare students for vocational education and apprenticeship trainings. Level A leads to white collar jobs and levels B and C lead to blue-collar jobs. Students in all three lower tracks attend school for three years and are typically 16 years old upon completion.

Figure 2: School Tracking and Measurement of Educational Outcomes



NOTE.—This figure illustrates the structure of the school system in the canton of Zurich. Children attend primary school for six years from ages seven to 12 (Grade 1 to Grade 6). At the end of primary school, at age 12, children are tracked either into academic high school (Gymnasium) or into regular high school (Sekundarschule). The tracking outcome is exclusively determined by children's grades in the final year of primary school and academic high school admission test scores. Children can either attend academic high school directly starting from Grade 7 (long-term *Gymnasium*) or from Grade 9 onward (short-term *Gymnasium*). The non-academic high school track comprises three lower tracks called Sek A, Sek B, and Sek C. Children attending regular high school can also transfer to academic high school after two or three years. The *Matura* degree, obtained upon completion of academic high school, is required to enroll in university. Students graduating from regular high school typically start an apprenticeship at age 16. Apprenticeships last two to four years. The red vertical bar indicates the intervention period. The yellow bars indicate the points in time when we observe educational outcomes.

The track the children will attend is determined by their grades in their last year of primary school and their scores on a standardized admission test measuring mathematics and language skills. Grades and test scores receive equal weight. Parents cannot choose the secondary school track and have no direct influence on the tracking outcome.

Two additional features characterize the school system in the canton of Zurich. First, after Grade 3, children are reassigned to new classes and teachers if school size permits. Second, children can switch between the different tracks throughout secondary school (see also Figure 2).

Students can obtain the *Matura* degree from an academic high school either through attending long-term academic high school or short-term academic high school. Tracking into long-term academic high school takes place after Grade 6. Tracking into short-term academic high school takes place after Grade 8 or 9. Later transitions are possible if a student has sufficiently high grades and passes the standardized admission test. During the first two probation years, over 30 percent of students initially tracked into academic high school fail to meet performance standards and move to a lower track. Additionally, a substantial number of students from the lower track move into the academic high school at different points in time. Therefore, the share of students in the highest track increases by 5 to 10 percent during the first three years of secondary school.

4. Experimental Design

4.1 Selection of Schools, Randomization, and Definition of Treatment Group

Selection of participating schools: Zurich consists of seven school districts and has a total of 90 primary schools. In each school district, eight schools were randomly selected to participate in the experiment. All 56 selected schools complied with the request of the City of Zurich's School and Sports Department to participate in the study.

Stratification and randomization: The 56 participating schools were assigned to 14 strata cells. These cells were constructed by dividing each of the seven school districts into two groups consisting of four similar-sized schools. Within each strata, each school was randomly assigned to one of four treatment groups using a random number generated in Microsoft Excel. Schools with the largest random number in each strata were assigned to the PATHS program (PATHS only). Schools with the second-largest number were assigned to the Triple P program (Triple P only). Schools with the third-largest number were assigned both to the PATHS and Triple P programs (PATHS & Triple P). Finally,

schools with the lowest number received neither the PATHS nor the Triple P intervention. These schools are the pure control group.

Definition of treatment and control groups: In this paper, we focus on the PATHS intervention and define the treatment group as the group of schools assigned to the one of the two PATHS treatment arms—either PATHS only or PATHS & Triple P combined. The control group consists of the pure control group and the Triple P-only group. Based on this definition, we have 28 treated and 28 control schools.

We include Triple P schools in the control group because this program had no impact on children's educational careers (Tables A9 and A10 in the Appendix). Triple P also had no impact on children's problematic behavior or educational outcomes (Malti, Ribeaud, and Eisner 2011; Eisner et al. 2012). Triple P has been shown to be effective for younger children (Doyle 2020). In our setting, however, participation rates were low: only 27 percent of parents assigned to Triple P enrolled in the program and attended at least one session. Less than 19 percent of parents assigned to Triple P completed all four course units. Triple P parents received on average less than two hours of intervention time. Eisner et al. (2011) show that parents who decided to attend courses were more likely to come from families with a high socio-economic background and of Swiss origin.

Given that there are four treatment arms of the original experimental design, we could also estimate effects for each of the three treatment groups separately. In Section 6.2 we show that this approach leads to similar results. Alternatively, we could drop all students that received the Triple P treatment and compare only the pure PATHS with the pure control group. We provide results based on this alternative sample definition in Section 6.2. While we lose about half of our observations with this definition, results remain very similar.

4.2 Implementation of the Intervention

In the 2005/06 school year, PATHS was implemented in 28 primary schools in cooperation with the Department of School and Sports of the City of Zurich. Prior to the implementation, the original PATHS material was translated and adjusted to the Swiss context by Rahel Jünger in collaboration with the US developers (Eisner et al. 2007). Rahel Jünger also implemented the program and conducted the teacher training and supervision. This implementation was done independently from the evaluation.

To prepare schools for delivering the PATHS intervention, all teachers in charge of running PATHS lessons participated in a three-day workshop with a PATHS coach. During this workshop the PATHS coach gave teachers an overview of the key concepts, classroom activities, posters, toys, and over 400 pages of materials. During the first year of the program, teachers regularly met their PATHS coach, who gave them feedback and support. PATHS coaches also monitored the implementation and observed six PATHS lessons for each participating class. After each of these observations, the coach provided suggestions for improvements and graded the quality of the implementation.

The 45-minute PATHS lessons typically took place twice per week. Treated children received PATHS lessons throughout the entire Grade 2. PATHS lessons replaced the class "Humans and Environment" (Mensch und Umwelt), which teaches children about the environment and organization of Swiss society. To reinforce the practice of PATHS methods, teachers also applied PATHS strategies in lessons not explicitly dedicated to the PATHS curriculum itself. Over the course of Grade 2, children received about 45 hours of PATHS lessons and about 20 hours of PATHS homework assignments (Eisner et al. 2007). Because the majority of teachers, parents, and children highly appreciated PATHS, over 70 percent of schools continued using the program for a second year in Grade 3. The program ended for all children at the end of Grade 3 when classes were reshuffled and students received a new teacher.

Implementing PATHS only cost USD 1,540 per class or USD 67 per student. These costs were for training and materials. The intervention did not lead to increased salary costs as the PATHS curriculum replaced an existing subject. We compare the costs of PATHS to other interventions in Section 8.2.

4.3 Outcome Variables and Descriptive Statistics

Outcome variables: We evaluate the long-term effects of the PATHS intervention on educational outcomes. The key outcomes of interest are whether individuals attend and complete the academic high school track (*Gymnasium*), whether they obtain the *Matura* degree, which allows them to enroll in any university, and whether they are enrolled in university at age 20.

We observe students' secondary school tracks at ages 13, 15, and 17 from administrative school data provided by the Department of Education of the Canton of Zurich. Some children leave the canton of Zurich and therefore disappear from the administrative data. We therefore complement the administrative records with self-

reported tracking outcomes at ages 13, 15, and 17 based on the z-proso survey.[8] We observe whether students complete academic high school and enroll in university from the wave 8 z-proso survey administered at age 20.

Table 1 shows that 16 percent of the participants attend academic high school at age 13, right after tracking has taken place. This number increases to 20 percent at age 15 and 26 percent at age 17.[9] Twenty-seven percent of children complete academic high school, and 17 percent are enrolled in university at age 20.

Baseline measures: Table 1 shows characteristics of children and parents measured at the baseline, that is, in the year before the start of the intervention. At this time, children were, on average, seven years old. Forty-eight percent are girls. Our sample comes from a diverse population: only 60 percent are Swiss, only 42 percent were born in Switzerland, and only 49 percent of mothers are Swiss. Seventeen percent of households are single-parent households. About 39 percent of mothers have at least completed academic high school (Gymnasium), and 16 percent hold a university degree. Fathers are slightly more educated than mothers, with 52 percent having completed Gymnasium or other types of higher education and 25 percent holding a university degree. The average family household income is USD 86,000 per year; 38 percent of families are entitled to state funded financial aid, and 18 percent report financial problems at the baseline.

Our data contain detailed baseline measures of child behavior assessed through the Social Behavior Questionnaire (SBQ) (Tremblay et al. 1991; Murray et al. 2019). The SBQ covers the following domains: ADHD symptoms (disruptiveness and impulsiveness), opposition and defiance, non-aggressive conduct disorder, anxiety and depressivity, aggression, and prosociality. At the baseline, SBQ measures are available from teacher, parent, and child reports. The data also contain measures of parenting practices assessed through the Alabama Parenting Questionnaire (APQ) (Shelton, Frick, and Wootton 1996). The APQ includes the following domains: corporal punishment, inconsistent discipline, parental supervision, parental involvement, and positive parenting.

[8] The z-proso study aims to track individuals even after they moved out of the canton or leave the country and has a remarkably low attrition rate. At age 20, we observe self-reported education outcomes for over 70 percent of the original sample (n = 1,675).

[9] The proportion of students in academic high school increases over time due to students' switching to *Gymnasium* from lower tracks during different stages of secondary school.

5. Empirical Strategy

5.1. Empirical Model

We aim to estimate the treatment effect of the PATHS intervention on educational outcomes. Equation (1) shows our main empirical model:

$$Y_{is} = \beta_1 \, \text{PATHS}_s + X'_{is}\gamma + \theta + \varepsilon_{is}, \quad (1)$$

where Y_{is} is the outcome of interest (attendance of academic high school at ages 13, 15, and 17, academic high school completion, and university enrollment at age 20) of individual *i* in school *s*. $PATHS_s$ is an indicator showing whether the school *s* was randomly assigned to participate in the PATHS program. β_1 is the parameter of interest. It captures the treatment effect of participating in the PATHS program.

Vector X_{is} contains baseline control variables. These differ depending on the specification. In our most complete specification, we include pre-treatment measures of child characteristics, household characteristics, and child socio-emotional skills. Child characteristics include age, gender, and Swiss citizenship. Household characteristics include household income, mother's age at the baseline, mother's education, father's education, and indicator variables for whether the mother was born in Switzerland and whether she has Swiss citizenship, whether the household is single-headed, whether the household reports receiving financial aid, and whether the household reports financial problems. For a child's socio-emotional skills, we rely on SBQ measures reported by the child, the teacher and the primary caregiver. These include ADHD symptoms (disruptiveness and impulsiveness), anxiety and depressivity, aggression, prosociality, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, and opposition and defiance. The model always includes strata fixed effects θ for the level at which randomization took place. ε_{is} represents the error term of the model.

We estimate Equation (1) using linear probability models and cluster standard errors at the school level. We additionally provide *p*-values based on randomization inference with 10,000 repetitions following Young (2018).

5.2. Balancing Tests

The identifying assumption of our empirical strategy relies on the random assignment of children to the treatment status. To verify this assumption, we test whether baseline

characteristics predict treatment status. In particular, we regress treatment status on each of the pre-treatment characteristics separately. We use all available characteristics on child and family demographics and measures for socio-emotional skills, and we estimate a total of 56 regressions.

Table 2 summarizes the balancing tests. Column (1) shows the number of statistically significant coefficients we obtain when regressing the indicator for treatment status (*PATHS*) on baseline characteristics. Column (2) shows the number of coefficients we would expect to find statistically significant due to chance variation. Overall, Table 2 suggests that the randomization was successfully implemented: the number of significant coefficients is similar to the expected number of significant coefficients under random assignment.

Table 3 provides a closer look at unbalanced variables by reporting point estimates from all 56 balancing regressions. The analysis reveals a substantial and significant imbalance ($p < 0.01$) in fathers' education levels between the treatment and the control group. Given that parental education is a key determinant of children's educational outcomes, this imbalance deserves careful consideration. Children receiving the PATHS intervention come from families with, on average, *less* educated parents. Treated children are about 10 percentage points less likely to have a father that holds at least an academic high school degree. This imbalance in fathers' education levels will make it *harder* for us to identify effects of the intervention if the treatment affects children's educational outcomes positively. Without accounting for this imbalance, we would *underestimate* treatment effects of the PATHS program. To assess how much this imbalance affects our results, we will provide results from three empirical specifications. The first specification does not control for parental education. The treatment effect estimate in this model will be downward biased due to the imbalance in parental education. The second specification accounts for this imbalance by controlling for parental education. As a final test, we estimate a specification with a full set of baseline control variables to test the sensitivity of our findings to including a large set of additional pre-treatment characteristics.[10]

[10] These additional pre-treatment characteristics include mother's age, child's age, household income, as well as indicators for whether the mother is a Swiss national, whether the mother was born in Switzerland, whether the child is a Swiss national, whether the child is female, whether the child has been raised in a single-parent household, whether the household has financial problems, and whether the household receives financial aid.

6. Results

In this section, we provide the main results of our analysis on the impact of the PATHS curriculum on educational careers. We also test whether these results are driven by selective attrition and estimate treatment effects for different subgroups.

6.1 Main Results

Table 4 shows estimates of the PATHS treatment effect on education trajectories. The outcome variables in columns (1)–(3) are indicator variables for attendance at academic high school at ages 13, 15, and 17. The outcome variables in columns (4) and (5) are indicator variables for academic high school completion and university enrollment at age 20, respectively. Panel A reports results without control variables. Panel B reports results with randomization controls for parental education to account for the imbalance between treatment and control groups at the baseline. Panel C reports results including randomization controls and a large set of additional baseline control variables.

Panel A of Table 4 provides estimates of the effect of the PATHS program from specifications without baseline controls. Despite having less-educated parents, children who attended the PATHS program appear to do better than children in the control group. While not statistically significant, the point estimates are positive for all outcomes. For example, treated children are 3.3 percentage points more likely to attend academic high school at age 17 and 2.3 percentage points more likely to have completed academic high school at age 20.

Panel B shows estimates that account for the imbalance in parental education at the baseline. In these specifications, we see positive and statistically significant treatment effects for all educational outcomes. The point estimates show that the PATHS program increases children's likelihood of attending an academic high school by 2.3 percentage points at age 13, by 4.1 percentage points at age 15, and by 6 percentage points at age 17. This effect increases with student age because PATHS students are more likely to transition to the academic track from lower-track schools. These effects translate into higher graduation rates. Attending PATHS increases children's likelihood of completing academic high school by 5.1 percentage points by age 20. This effect represents a 20 percent increase over the completion rate of the control group. Finally, we also see that attending PATHS increases children's likelihood of enrolling in university by 3.6 percentage points (21 percent).

Panel C of Table 4 shows results including controls for parental education and a large set of additional baseline control variables for child characteristics, household characteristics, and child socio-emotional skills. Results are robust to including this large set of additional control variables and the *R*-squared increases substantially. Despite the lower number of observations due to missing values in our control variables, point estimates in the model with randomization controls (Panel B) and the full set of controls (Panel C) are not statistically different from each other. Point estimates in these specifications show that PATHS increases children's likelihood of completing academic high school by 7.1 percentage points (23 percent) and increases their likelihood of enrolling in university by 4 percentage points (21 percent). Table A3 in the Appendix replicates the analysis in panel C using imputed values for missing control variables. The analysis shows that the imputation provides us with a larger estimation sample and that the PATHS treatment effect remains similar to the estimates in Panels B and C of Table 4. Thus, including covariates with missing values does not create spurious treatment effects.[11,12]

Figure 3 summarizes how the PATHS treatment effect evolves over time and provides a comparison between the models without controls (panel a), with randomization controls (panel b), with the full set of baseline control variables (panel c), and with imputed control variables (panel d). The similarity of results between panels (b), (c), and (d) points to the robustness of our findings: our estimates are not sensitive to including a large set of control variables.[13,14]

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[11] We test whether treated children are more likely to have non-missing control variables in Panel B of Table A4. We regress an indicator taking the value of one if no control variables are missing on the treatment status. The analysis shows that the treatment and control groups do not differ in their probability of having missing control variables.

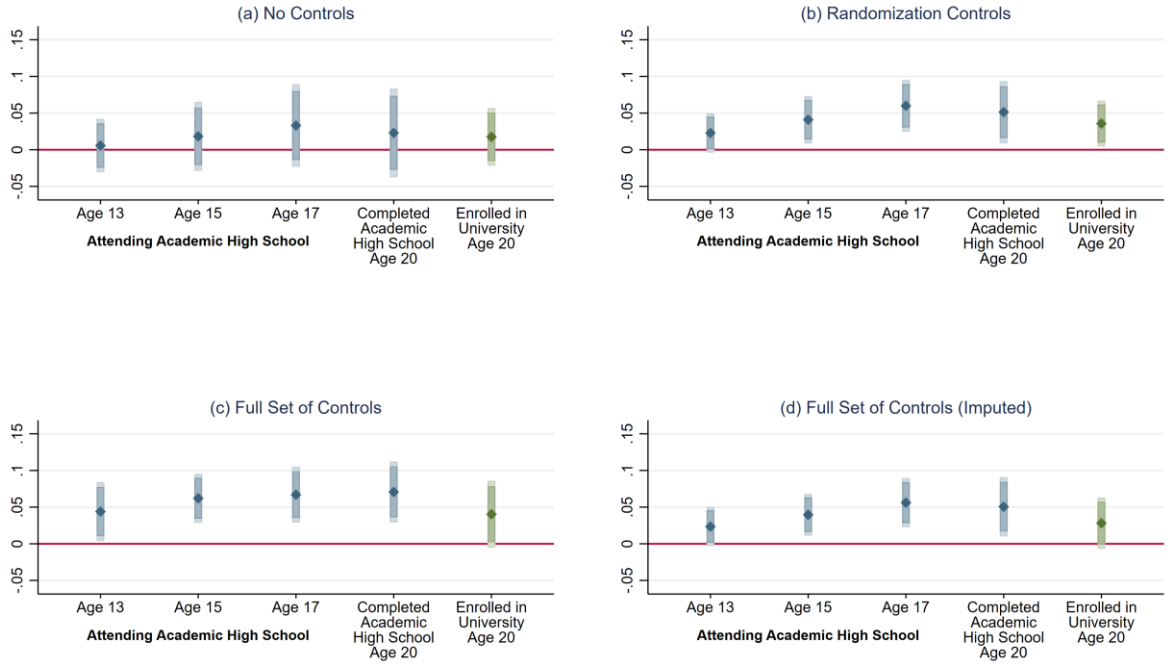
[12] As we test multiple hypothesis by looking at different educational outcomes over time, we also estimate treatment effects using (1) an aggregate index for the educational success of children through ages 13, 15, 17, and 20 as a dependent variable, and (2) a pooled regression. For the construction of this education index, we follow Anderson (2008). Table A5 shows that *p*-values are generally smaller in the models in which we use an index or a pooled regression and that our overall conclusions are the same.

[13] We also investigate whether the treatment affects other outcomes at age 20. Figure A6 in the Appendix shows that treated individuals are more likely to be enrolled in education or vocational training and less likely to be searching for vocational training or other further education. Conditional on not being in education or training, treated individuals are more likely to be employed full-time. We do not find that the intervention affects the probability of having no educational degree or the probability of being unemployed. Given that individuals are only 20 years old, it is probably too early to provide conclusive evidence on their labor market outcomes.

[14] Over 70 percent of schools assigned to the treatment group implemented PATHS for two years. In Appendix Section A5, we test for dosage effects of the intervention. Although this analysis does not allow for a causal interpretation of the results, we find some suggestive evidence that children benefit more if they are exposed to the treatment for a longer time. In Appendix Section A6, we investigate whether the treatment effect creates a potential mismatch between students and high schools. We find no evidence that marginal students who got pushed into academic high school by the treatment perform relatively worse in the more challenging school track.

Overall, we observe large and economically significant effects. In the average class in our sample, five out of 28 children attend university at age 20. The size of the treatment effect implies that one additional child—six instead of five—will attend university due to the intervention. The size of our treatment effect for attending academic high school (a 20 percent increase) is very similar to the treatment effect of the mentoring program Baloo and You on the same outcomes in Germany (a 23 percent increase; Falk et al. 2020). The effect size we find is equivalent to one-seventh of the treatment effect of the Abecedarian program on college attendance (Campbell et al. 2014) and about one-quarter of the size of the Perry Preschool Program on high school completion (Heckman et al. 2010a). We discuss our effect sizes and how they compare to other childhood interventions in Section 8.

Figure 3: Main Results – Treatment Effects on Educational Outcomes



NOTE.—This figure is based on estimates shown in Tables 4 and A3 and shows the treatment effect of the PATHS intervention on the probability of attending academic high school at age 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. In panel (a), we do not include any controls. In panel (b), we include randomization controls for mother's and father's education levels. In panel (c), in addition to the randomization controls, we control for baseline child, parental, and household characteristics as well as baseline child SBQ measures. In panel (d), we impute missing controls for baseline child, parental, and household characteristics and baseline child SBQ. The imputation process assigns the overall sample mean to each observation with missing information for a continuous control variable and a new missing category to each observation with missing information for an indicator variable. All models in panel (d) also include indicator variables if a variable is imputed. Child controls include age, gender, and if the child has Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for single-parent household, household that received financial aid, and household that experienced financial problems. Controls for baseline child SBQ measures include anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Details on the SBQ items and construct validity are provided in the Appendix Section A4. Each point estimate is shown

with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

6.2 Robustness Analysis

In this section, we assess the robustness of our results in four ways. First, we test whether our conclusions remain the same if we compute *p*-values based on randomization inference. Second, we estimate specifications using an alternative treatment group definition. Third, we test whether selective attrition drives our results. Fourth, we discuss possible concerns of experimenter demand effects.

Randomization inference: In the main analysis, we cluster standard errors at the school level, resulting in 56 clusters. As a robustness test, we compute *p*-values based on randomization inference using 10,000 random permutations following Young (2018). With this procedure we account for possible bias in standard errors due to a small number of clusters. Table 4 shows that *p*-values based on randomization inference lead to the same overall conclusions.

Alternative treatment group definitions: Our baseline analysis compares individuals exposed to PATHS (treatment) to individuals who were not exposed to PATHS (control). However, some individuals in the treatment and control groups were also exposed to the Triple P program. In Table A9 in the Appendix we show estimates comparing individuals who were assigned to the Triple P program versus individuals who were not exposed to Triple P. This table shows that the Triple P intervention has no significant effect on educational outcomes. The lack of effects for Triple P is consistent with Eisner et al. (2012), who show that the intervention had no short-term effects on either parenting practices or child problem behavior.

An alternative evaluation strategy is to drop all students that received the Triple P treatment and compare only the pure PATHS with the pure control group. In Table A6 in the Appendix we show that, although we lose about half of our observations, results remain very similar.

Alternative treatment group definitions – full 2x2 design: Table A10 provides additional evidence on the robustness of our results by comparing all treatment arms of the original experiment. The outcome of interest is an indicator for academic high school

completion. Panel A and Panel B confirm that PATHS, in contrast to Triple P, is effective. Panel C in Table A10 reports estimates for a model that include an interaction effect between the two interventions PATHS and Triple P. The PATHS treatment effect in Panel C is similar to Panel A and confirms that children exposed to PATHS are more likely to complete academic high school. As in Panel B, children exposed to the Triple P program are not significantly affected. The interaction effect between both interventions (PATHS * Triple P) is small and never reaches statistical significance in any of the columns (1)–(5). These results highlight that there is no additional benefit from exposure to both programs.

Selective attrition: To test for selective attrition, we estimate the effect of attending the PATHS program on the probability of observing an individual in our estimation sample at four different points in time: at ages 13, 15, 17, and 20.[15] More specifically, we regress an indicator showing whether we observe the individual in our sample at a given time on a PATHS treatment indicator. Table A4, Panel A, shows that the treatment does not affect the probability of being observed in the sample at different points in time. The *PATHS* coefficients are small and not statistically significant in all specifications. Selective attrition does not appear to drive our results.[16]

Demand effects: As in any social experiment, our results raise the question of whether knowledge of treatment or experimenter demand effects could drive treatment effects. Two reasons speak against this. First, tracking in Switzerland is determined by two objective student performance measures: (1) grades in core subjects in the last grade of primary school, and (2) standardized externally evaluated admission test scores. Therefore, tracking is not a choice variable, and it is not determined by subjective teacher recommendations. Second, those teachers involved in the program in Grade 2 have no direct or indirect influence on the tracking decision that takes place four years later. At the end of Grade 3, after the intervention is completed, children are reassigned to new teachers

[15] Data are missing at ages 13, 15, and 17 when individuals move out of the canton of Zurich and refuse to participate in the survey. Outcomes for academic high school completion and university enrollment are based on self-reported information and are only available for those individuals participating in the wave 8 survey.
[16] Although we do not find any evidence of selective attrition, we also replicate our main results following Wooldridge's (2007) inverse probability weighting in Appendix Table A7. We first model attrition for each outcome variable as a function of the initial assignment to a specific treatment condition and the full set of control variables used in the baseline analysis. Then, we predict individual attrition probabilities. In the estimation, we then weight each observation with the inverse of this probability to account for the probability of being observed in a specific administrative register or survey wave of the data collection. Appendix Table A7 shows that all main results remain similar when using inverse probability weighting.

uninvolved in the intervention. It is therefore not plausible that these new teachers—who did not implement the program—manipulated treated students' grades four years after the end of the program to push them into academic high school. Third, the competitive tracking system and the fact that the treatment effect persists over time reject the interpretation that demand effects drive our results. If the intervention motivated teachers to inflate treated students' grades and pushed unqualified students into academic high school, they would not have survived in this competitive track. During the first two probation years, over 30 percent of students initially tracked into academic high school fail to meet performance standards and consequently move to the lower track. At the same time, a substantial number of students from the lower track move up into the academic high school at different times. If initial treatment effects had been driven by teacher-inflated grades, these students would not have survived the competitive environment of academic high schools. The fact that students move substantially between tracks in combination with the lasting treatment effect for academic high school completion reject the idea that demand effects or knowledge of the treatment status could be driving our main results.

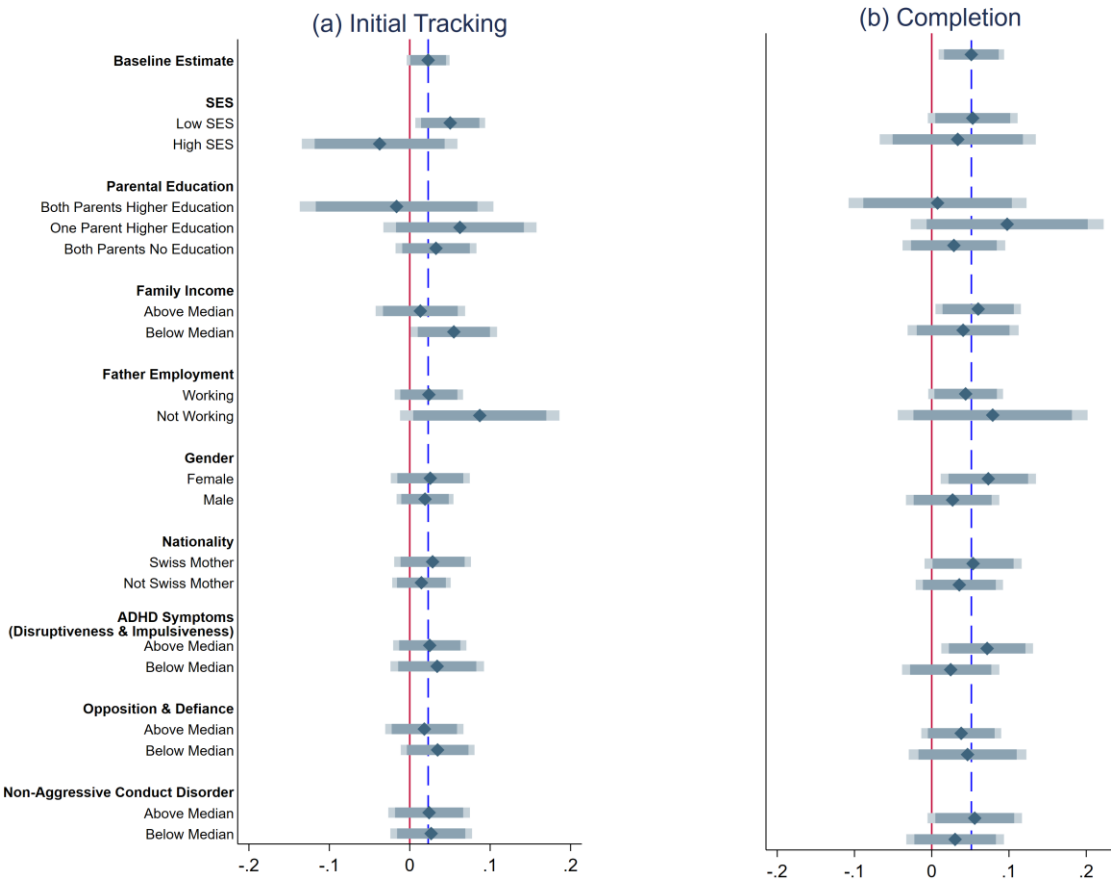
6.3 Heterogeneous Treatment Effects

Figure 4 investigates possible heterogeneous treatment effects for the impact of PATHS. Panel (a) shows effects for initial tracking at age 13 and panel (b) shows effects for academic high school completion. We estimate heterogeneous effects for the following dimensions: family socio-economic status (SES), parental education, family income, father's employment status, child's gender, citizenship status of the mother, and child's baseline socio-emotional skills including ADHD symptoms, opposition and defiance, and non-aggressive conduct disorder. We construct indicator variables for each dimension. For socio-economic status (SES), we construct an indicator equal to one if either the family is in the bottom quintile of the income distribution, the father is unemployed, or both parents did not complete academic high school. For family income, we consider an indicator for being above or equal to the sample median. For parental education, we consider three indicators: both parents with higher education, only one parent with higher education, and both parents without higher education. For children's socio emotional skills, we split the sample according to the baseline median value. We estimate heterogeneous effects by augmenting equation (1) with interaction terms between the treatment variable and

indicators for different subgroups. Figure 4 shows the estimation results with the respective subgroup shown on the y-axis.

Overall, Figure 4 suggests that there is no systematic heterogeneity in the treatment effect. Treatment effects are not statistically different between subgroups. However, the analysis of heterogeneous effects by family socio-economic background reveals some interesting suggestive patterns. Panel (a) seems to suggest that the PATHS intervention is slightly more beneficial for those children from a relatively more disadvantaged background. The point estimates are indeed larger for low-SES children than for high-SES children. The same pattern holds true for parental education, family income, and father's working status. While these differences fail to reach statistical significance, they are consistent with the idea that the treatment might be more effective for initial tracking outcomes of disadvantaged children. For academic high school completion in panel (b), we observe smaller treatment effect differences between subgroups.

Figure 4: Heterogeneous Treatment Effects for Academic High School Tracking and Completion



NOTE.—This figure shows heterogeneous treatment effects for the initial and final tracking outcomes by socio-economic status (SES), parental education, family income, father's employment status, child gender, and nationality of child's mother, as well as on baseline child SBQ measures for ADHD symptoms (disruptiveness and impulsiveness), opposition and defiance, and non-aggressive conduct disorder. Estimates are based on models in Table 4, Panel B, which include randomization controls. More specifically, panel (a) corresponds to the model in column (1), while panel (b) corresponds to column (4). The dashed line in panel (a) indicates the overall treatment effect shown in column (1) and, in panel (b), that shown in column (4). Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

7. Mechanisms

In this section, we study a set of intermediate outcomes related to four possible mechanisms. These intermediate outcomes may represent mechanisms for the effect of the PATHS program on educational trajectories. First, we analyze whether PATHS affected the two elements that determine the tracking outcome: primary school grades and academic high school admission test scores. Second, we study whether PATHS affected children's socio-emotional development—the main target of the intervention. Third, as some of the PATHS activities involve parent-child interactions, we test whether the intervention affected parenting practices. Fourth, we investigate whether PATHS affected school-related behavior like classroom disruption and homework completion.[17]

7.1 Effects on Grades and Admission Test Scores

Primary school grades are given on a scale of 1–6 and are based on tests and the subjective assessments of the primary school teacher. The standardized high school admission test is graded on that same 1–6 scale and covers mathematics, reading comprehension, and writing. The test is evaluated by an external high school teacher who typically does not know the child. Students' tracking outcomes are determined by their average primary school grades and their admission test scores. Both performance measures have equal weight and students with a minimum of 4.5 out of 6 are admitted to academic high school.[18]

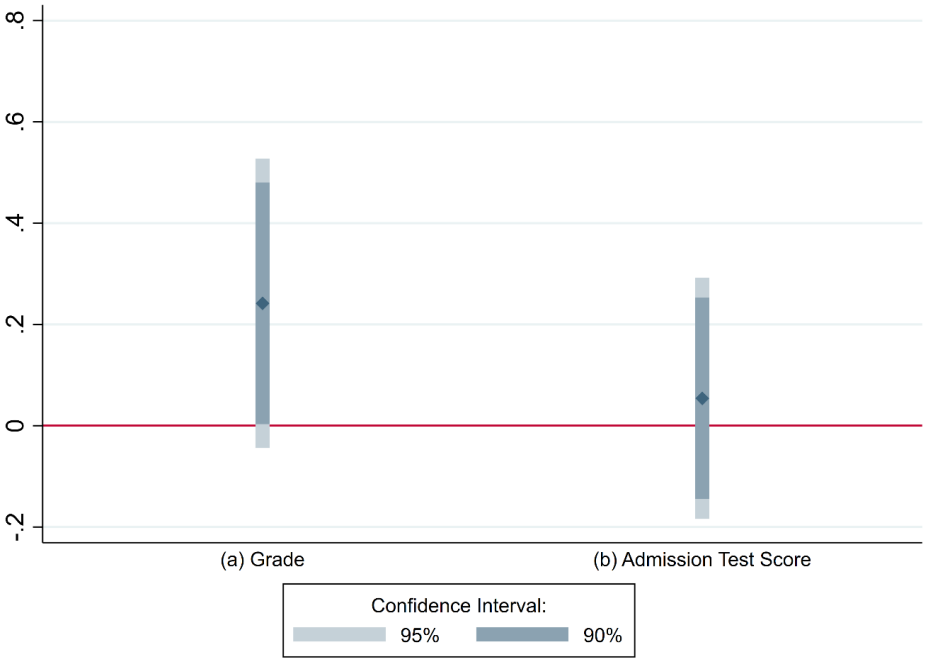
We estimate the effect of PATHS on grades and admission test scores using the specification with the full set of controls. To simplify the interpretation of the results, we

[17] Appendix Section A7 reports a mediation analysis providing suggestive evidence on how much of the treatment effect can be explained by the mechanisms we investigate in this section. The analysis is only suggestive of the relative importance of alternative mechanisms as we effectively have only one instrument for multiple channels that may drive the treatment effect.

[18] Participation in the academic high school admission test is voluntary and there is some suggestive evidence that the treatment increases children's probability of taking the test (see Table A8 in Appendix). To account for the fact that we only observe a subsample of children, we reweigh our observations in Figure 5 using inverse probability weighting.

standardized both outcome variables to have means of zero and standard deviations of one. Figure 5 shows that the PATHS program increases children's grades by more than 20 percent of a standard deviation.[19] Figure 5 also shows the treatment effect on the admission test scores. Point estimates on test scores are lower and amount to about 5 percent of a standard deviation. While this coefficient is imprecisely estimated and not statistically significant, we cannot fully rule out that the treatment had some positive impact on the standardized admission test.

Figure 5: Treatment Effects on Grades and Admission Test Scores



NOTE.—This figure shows the treatment effect of the PATHS intervention on grades and test scores. Both models include strata fixed effects for the level of randomization and a full set of controls. Furthermore, both regressions are based on inverse probability weighting, with weights constructed by regressing an indicator for whether we observe any grade or test score on the full set of controls except child SBQ, and then taking the square of the inverse predictions. The dependent variable in the first plot (a) is a student's standardized grades in Grade 6. The dependent variable in the following plot (b) is the child's score on the centralized admission test for academic high school. Admission to academic high school is possible after Grade 6, 8, and 9. Estimates for admission test scores are based on the score obtained from the first time taking the test. Grades in primary school correspond to the teacher-given grades obtained before taking the admission test. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

Taken together, our results suggest that the intervention raises grades but has only a limited impact on admission test scores. On the one hand, test scores mainly capture

[19] Grades are likely determined on a curve within schools and might therefore not be comparable across schools. Given that all students within a school have the same treatment status, any within-school curving would lead to an underestimation of treatment effects on (uncurved) grades.

dimensions of children's cognitive skills. On the other hand, grades are likely to also reflect differences in classroom behavior, aptitude, and engagement.[20] One plausible interpretation for the effects is that treated children display better classroom behavior that is rewarded with higher grades by the teacher. Our results suggest that long-term intervention effects are more likely to operate through changes in socio-emotional skills rather than cognitive skills.

7.2 Effects on Socio-Emotional Skills

PATHS aims to foster regulatory behavior, smart decision-making, and emotional understanding. Given these primary goals, we investigate changes in children's socio-emotional development as possible mechanisms of the long-term effects of PATHS on educational trajectories.

We measure children's socio-emotional development with the Social Behavior Questionnaire (SBQ), which teachers and parents answer. This questionnaire includes the following six domains: (1) ADHD symptoms (disruptiveness and impulsiveness), (2) opposition and defiance, (3) non-aggressive conduct disorder, (4) anxiety and depressivity, (5) aggression, and (6) prosociality. Each of these domains is measured with up to ten subitems that ask about the prevalence of a specific behavior.[21] For every survey wave, we combine all available responses from the primary caregiver and the teacher. We do this by first computing the sum of standardized answers to each subitem domain, then take the average of teacher and primary caregiver reports and standardize again to obtain measures with a mean of zero and a standard deviation of one.

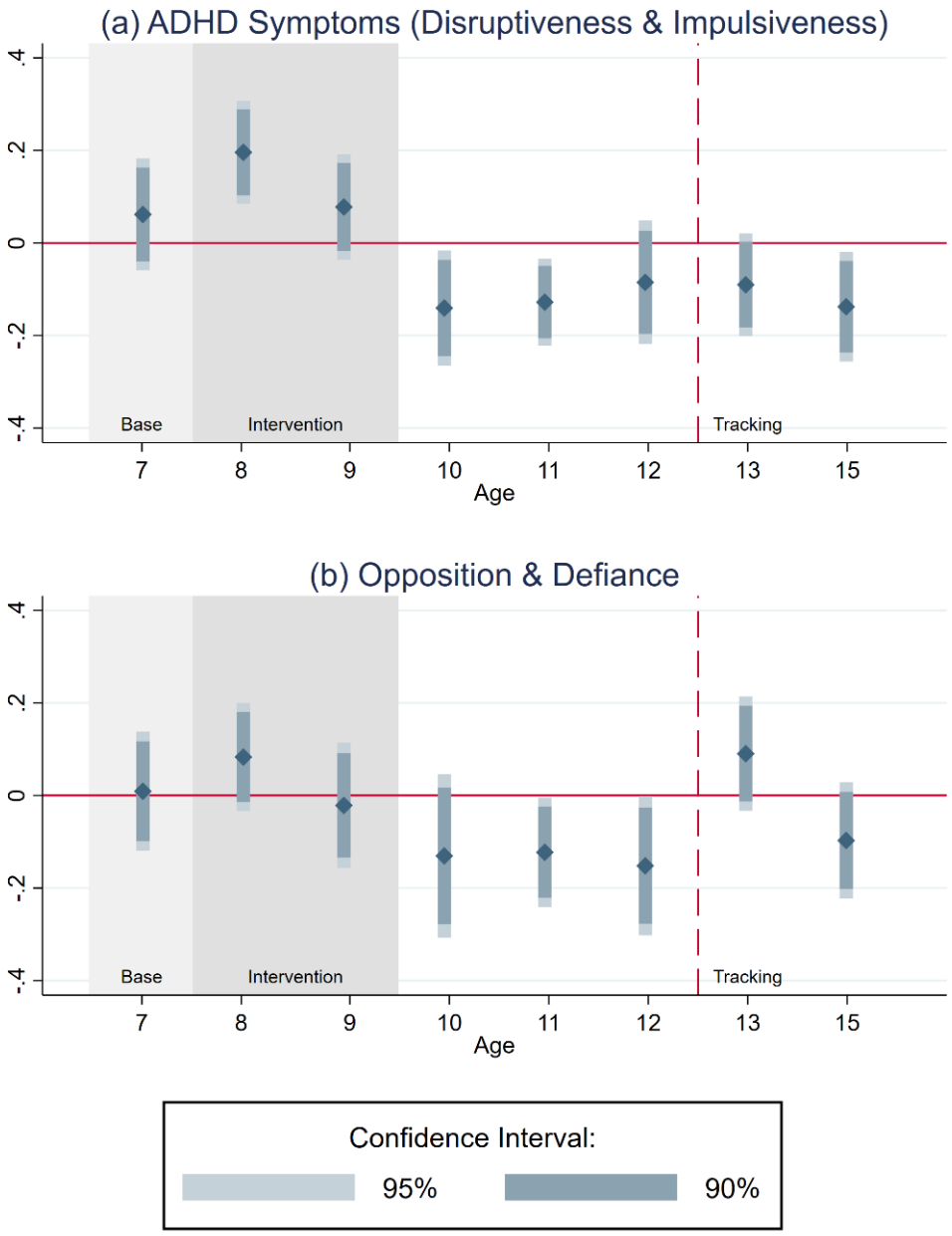
Figure 6 shows the PATHS treatment effect on ADHD symptoms and opposition and defiance. Panel (a) of Figure 6 shows the evolution of the PATHS treatment effect on ADHD symptoms (disruptiveness and impulsiveness) over time. PATHS causes children to become *more* impulsive and disruptive during the intervention period and persistently *less* impulsive and disruptive after the intervention is completed.

Seeing more behavioral problems during the intervention is, at first sight, surprising. This effect goes against the aim of the intervention. One explanation is that the

[20] Borghans et al. (2016) study the predictive power of socio-emotional skills for grades and achievement test scores and show that grades are more influenced by students' personality traits and socio-emotional skills than achievement tests.

[21] Appendix Table A11 provides an overview of the items used in the Social Behavior Questionnaire that constitute the six different SBQ domains. Answers are recorded on a 5-point Likert scale ranging from 1 "never" to 5 "very often."

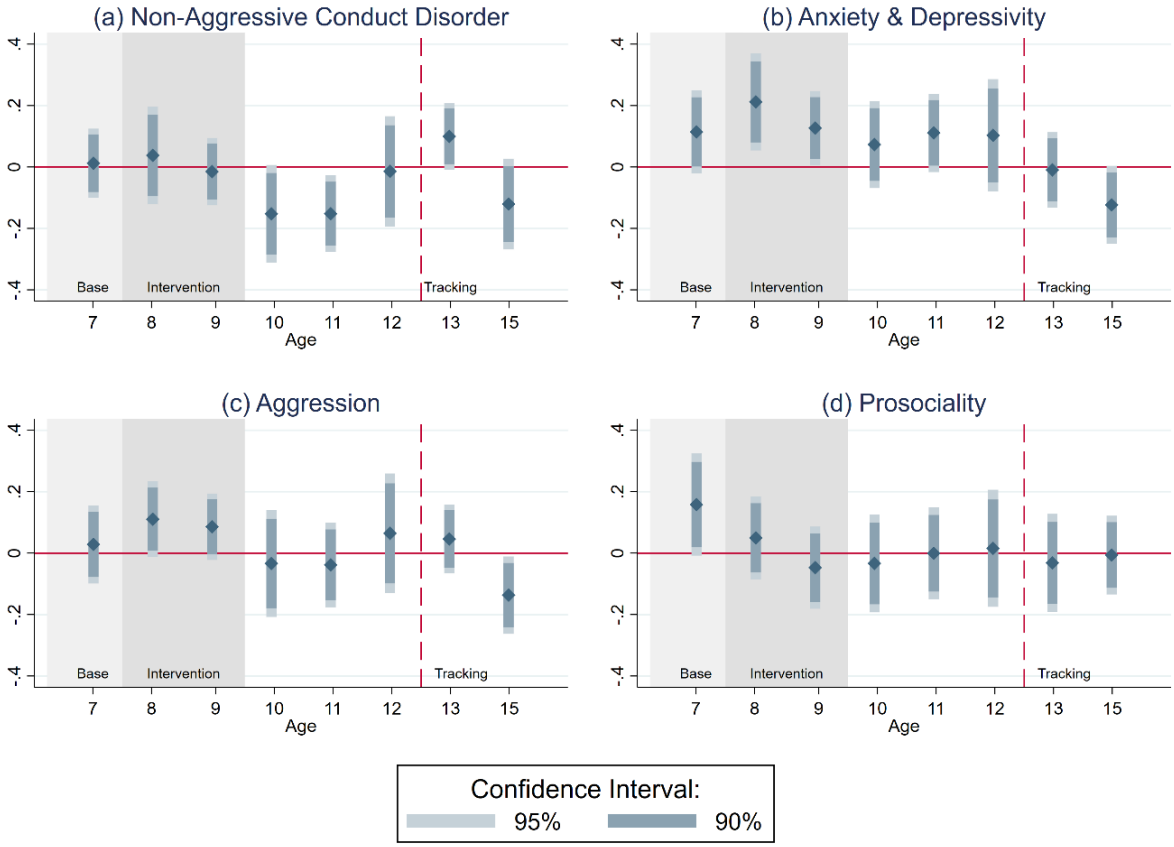
Figure 6: Dynamic Treatment Effects on Socio-Emotional Skills I



NOTE.—This figure shows the treatment effect of the PATHS intervention on children's socio-emotional skills from ages seven through 15. The dependent variable in panel (a) is ADHD symptoms (disruptiveness and impulsiveness). The dependent variable in panel (b) is opposition and defiance. All dependent variables are indices standardized to mean zero and a standard deviation of one. All models include strata fixed effects for the level of randomization. All models include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. To provide evidence on balance across the treatment and the control groups, we do not include individual controls in the estimation of the treatment effect at age seven. For each SBQ measure, we combine measures from teacher and parent reports by taking the average of the two standardized indices and standardize the resulting index again. For measures at ages 10, 12, 13, and 15, we rely solely on teacher reports, as there are no parent surveys at these times. Details on the SBQ items and construct validity are provided in the Appendix Section A4. Shaded areas indicate the baseline and the intervention periods. The dashed vertical line shows the time when tracking into secondary schools takes place. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

intervention made teachers and parents more aware of what appropriate child behavior should look like. This possible increased awareness may have made them more critical in the short run. Consistent with this interpretation, the PATHS developers provide anecdotal evidence showing that teachers raise their expectations about children's appropriate behavior during the intervention.

Figure 7: Dynamic Treatment Effects on Socio-Emotional Skills II



NOTE.—This figure shows the treatment effect of the PATHS intervention on children's socio-emotional skills from ages seven through 15. The dependent variables are non-aggressive conduct disorder (panel a), anxiety and depressivity (panel b), aggression (panel c), and prosociality (panel d). All dependent variables are indices standardized to mean zero and a standard deviation of one. All models include strata fixed effects for the level of randomization. All models include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. To provide evidence on balance across the treatment and the control groups, we do not include individual controls in the estimation of the treatment effect at age seven. For each SBQ measure, we combine measures from teacher and parent reports by taking the average of the two standardized indices and standardize the resulting index again. For measures at ages 10, 12, 13, and 15, we rely solely on teacher reports, as there are no parent surveys at these times. Details on the SBQ items and construct validity are provided in the Appendix Section A4. Shaded areas indicate the baseline and the intervention period. The dashed vertical line shows the time when tracking into secondary schools takes place. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

After the intervention, starting from age ten, we see that PATHS reduces ADHD symptoms by making children less disruptive and impulsive. At age ten, children were also reassigned to new classes and new teachers who were not involved in the intervention. From this age, our measures therefore likely reflect child behavior and development more objectively. The treatment effect persists until primary school completion, when children are 12 years old, and remains visible at ages 13 and 15.[22]

Panel (b) of Figure 6 shows the PATHS treatment effect on opposition and defiance. Opposition and defiance capture behaviors like telling lies, cheating, or ignoring teachers' instructions. The overall picture is similar to the treatment effect for ADHD symptoms. PATHS increases opposition and defiance during the intervention and decreases those behaviors after the intervention is completed. The treatment effects fade out after children transition to secondary school.

Figure 7 shows the effects of PATHS on non-aggressive conduct behavior (panel a), anxiety and depressivity (panel b), aggression (panel c), and prosociality (panel d). PATHS reduces children's non-aggressive conduct disorders such as lying, stealing, or destroying other children's belongings after the intervention. This effect remains visible until age 11 and fades out afterward. Anxiety, aggression, and prosociality do not appear to be systematically affected by the intervention.

7.3 Effects on Parenting Practices

The PATHS program includes information leaflets for parents and has a substantial homework component. In these homework assignments, children discuss the curriculum with their parents. The PATHS program therefore may affect parent-child interactions or trigger adjustments in parenting practices.[23]

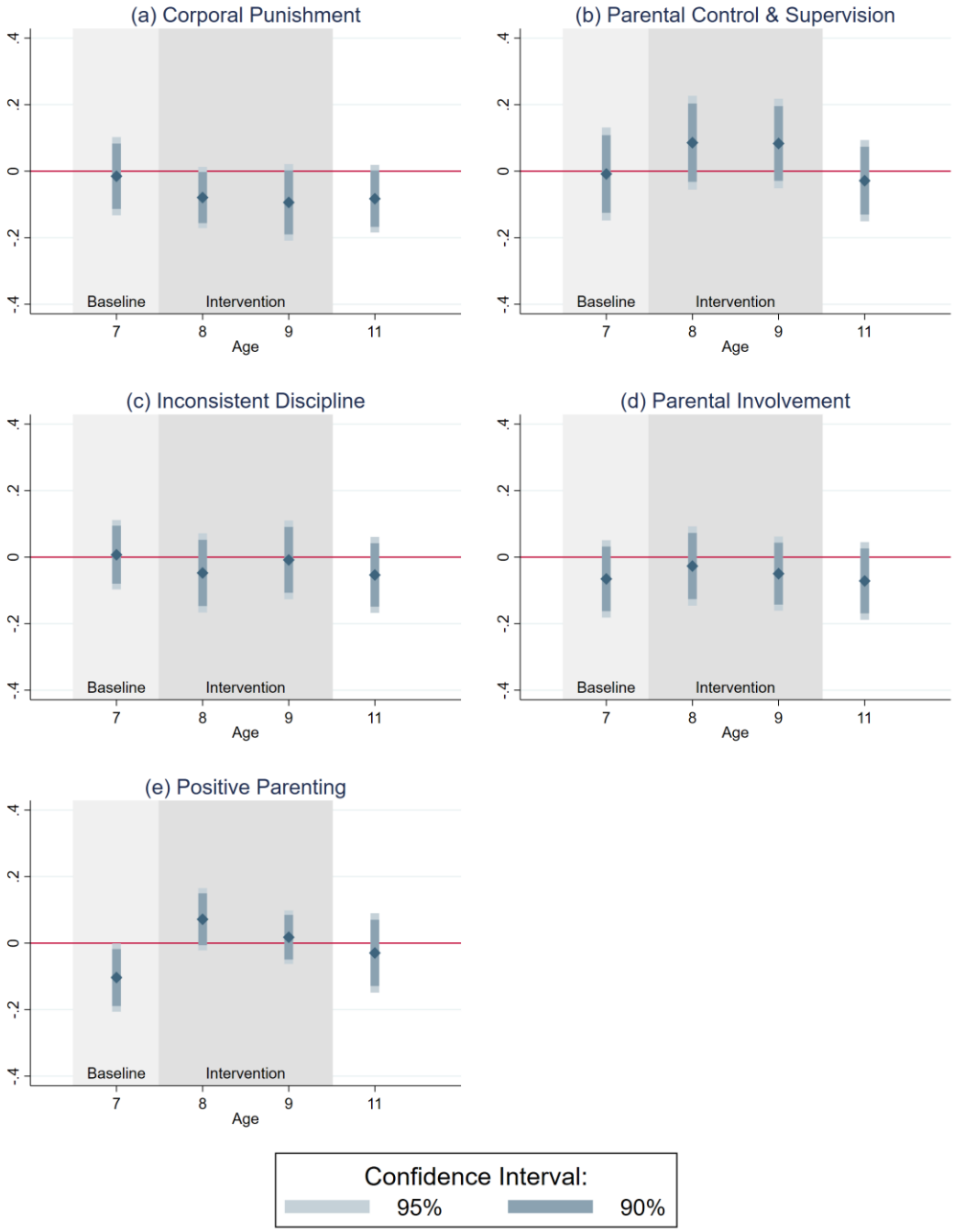
We analyze parenting practices using the Alabama Parenting Questionnaire (APQ) that captures the following five domains: (1) corporal punishment, (2) parental control and supervision, (3) inconsistent discipline, (4) parental involvement, and (5) positive parenting. Each domain is measured with up to 10 questions answered by the primary

[22] Figure A10 in the Appendix reports separate effects for disruptiveness (panel a) and impulsiveness (panel b). The figure shows that the overall picture is similar for both traits, but perhaps more pronounced for disruptiveness.

[23] Parenting styles and practices may shape child preferences and behavior with effects on children's education performance and choices (Doepke and Zilibotti 2017; Doepke, Sorrenti, and Zilibotti 2019). Adjustments in parenting practices therefore represent a possible mechanism for the observed PATHS treatment effects on educational outcomes.

caregiver on a 5-point Likert scale ranging from "never" to "always."[24] To facilitate comparisons, we standardize each subdomain to have a mean of zero and a standard deviation of one.

Figure 8: Dynamic Treatment Effects on Parenting Practices



NOTE.—This figure shows the treatment effect of the PATHS intervention on parenting practices from ages seven through 11. The dependent variables are corporal punishment (panel a), parental control and supervision (panel b), inconsistent discipline (panel c), parental involvement (panel d), and positive parenting (panel e). All dependent variables are indices standardized to mean zero and a standard deviation of one. All

[24] Appendix Table A13 provides an overview on the survey items used to measure parenting practices. Items remain the same across surveys conducted in different years.

models include strata fixed effects for the level of randomization. All models include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. To provide evidence on balance across the treatment and the control groups, we do not include individual controls in the estimation of the treatment effect at age seven. Shaded areas indicate the baseline and the intervention periods. The dashed vertical line shows the time when tracking into secondary schools takes place. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

Figure 8 shows the evolution of the PATHS treatment effect on parenting practices over time. Parents seem to respond to the intervention with less corporal punishment during and right after the intervention period. When the child is 11 years old, PATHS appears to reduce the use of physical punishment (e.g., hitting and smacking) by 8.4 percent of a standard deviation. However, it is possible that the PATHS intervention provides incentives to parents to report reduced negative parenting regardless of actual punishment behavior. This possible reporting bias due to the social desirability of not reporting corporal punishment could be considered an unintended consequence of the PATHS treatment and makes it challenging to interpret treatment effects on corporal punishment.

Specifically, the treatment effect on corporal punishment could be driven by three factors. First, children exposed to the PATHS program might improve their behavior, thereby reducing parental corrective actions. Second, parents might become less impulsive and stop hitting their kids. Third, parents might feel pressured to *report* reductions in corporal punishment, as the PATHS program stresses the importance of non-violent social interactions. In this third case, the treatment may have induced reporting bias. Given that information on smacking, slapping, and hitting is self-reported, how to interpret the reported effect on corporal punishment remains ambiguous.

According to the remaining analyses in Figure 8, we see no effect of the PATHS program on other parenting practices. Overall, the analysis in this section suggests a negligible effect of the PATHS program on those practices. Therefore, changes in parenting are very unlikely to drive the PATHS treatment effect on educational outcomes.

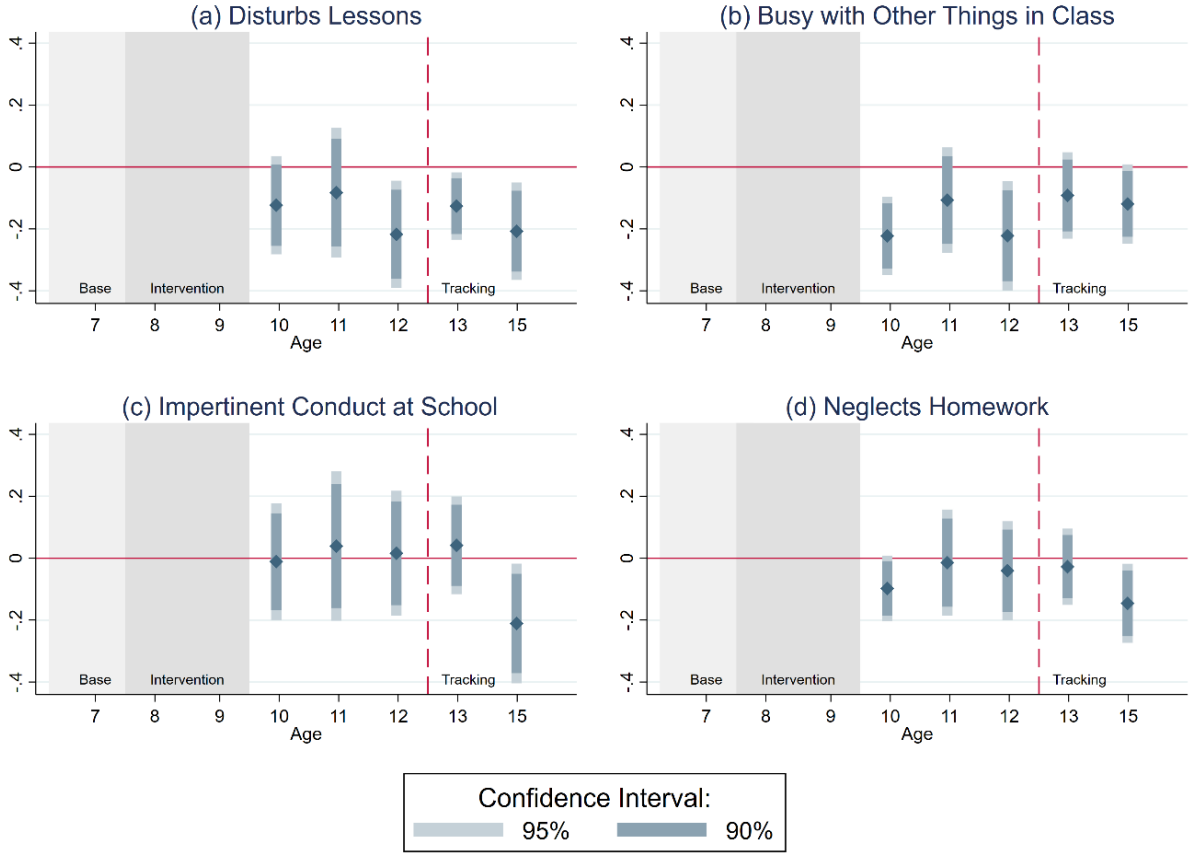
7.4 Effect on Behavior in Class

In this section, we look at possible intervention effects on school-related behavior. We have measures on school-related behavior for four different domains: (1) disturbing lessons, (2) being busy with other things during classes, (3) displaying impertinent school behavior, and (4) neglecting homework. We observe these outcomes starting from Grade 4, after children are reassigned to new classes and evaluated by a new teacher. Each domain is measured through a 5-point Likert scale ranging from "never" to "very often." To

facilitate comparisons, we standardize each subdomain to have a mean of zero and a standard deviation of one.

Figure 9 shows results for school-related behavior. PATHS reduces children's likelihood of disturbing lessons by 12.4 percent at age 10. The effect persists throughout secondary education. We see a similar pattern for children's ability to focus. Treatment effects are largest immediately after the intervention at age 10 with an effect equivalent to a reduction of 20.4 percent of a standard deviation. The effect remains visible after children are tracked. We find no significant treatment effects for impertinent conduct at school or neglecting homework.

Figure 9: Dynamic Treatment Effects on Behavior in Class



NOTE.—This figure shows the treatment effect of the PATHS intervention on children's behavior at school from ages 10 through 15. The dependent variables are disturbing the lesson (panel a), being busy with other things in class (panel b), displaying impertinent conduct at school (panel c), and neglecting homework (panel d). All dependent variables are indices standardized to mean zero and a standard deviation of one. All models include strata fixed effects for the level of randomization. All models include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. Measures are taken from teacher reports. Shaded areas indicate the baseline and the intervention periods. The dashed vertical line shows the time when tracking into secondary schools takes place. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

7.5 Multiple Hypothesis Testing

We estimate treatment effects for a substantial number of outcomes. This implies that some statistically significant effects might simply represent chance findings. We address this concern by (1) testing which estimates remain significant after grouping outcomes, (2) correcting for multiple hypothesis testing, and (3) creating an overall index for children's socio-emotional and cognitive development measured post treatment.

Heckman et al. (2010a) points out that there is some arbitrariness in defining the blocks of hypotheses to be jointly tested in a multiple hypothesis testing procedure. Specifically, it is unclear whether all outcomes, no matter how *minor* they are, are of interest for multiple hypothesis testing and thus need to be included in the procedure. We apply a simple and conservative criterion for our analysis: drawing on the fact that PATHS mainly targets children's socio-emotional, behavioral, and cognitive development, we include all child outcomes analyzed as mechanisms. To put it differently, we include all of the socio-emotional, behavioral, and cognitive measures for children and do not include parents' parenting practices.

Socio-emotional skills and classroom behavior are measured at multiple points in time. We can substantially reduce the number of hypotheses tested by creating a post-intervention index for a given skill. We can then test whether the intervention affected average post-intervention measures of a skill domain. To aggregate a given domain, we first standardize each period-specific measure. We then calculate the mean over all post-treatment periods and standardize again. This results in ten distinct socio-emotional and two cognitive skills measures.

Table 5 shows treatment effects for these ten socio-emotional skill measures plus grades and admission test scores. Results highlight that the post-treatment indexes for ADHD symptoms (column 3), opposition/defiance (column 4), non-aggressive conduct disorder (column 5), disturbing lessons (column 9), and being busy with other things (column 10) are significantly affected by the intervention. In other words, children exposed to the PATHS program significantly improve their post-treatment behavior in these realms.

Given that some of these significant effects may still represent chance findings, we next apply a Bonferroni correction. Table 5 reports the Bonferroni (Abdi 2007) and Bonferroni-Holm (Holm 1979; Jones, Molitor, and Reif 2019) corrected *p*-values for the twelve socio-emotional and cognitive measures we investigate as candidate mechanisms. While the marginally significant treatment effects for grades and non-aggressive conduct

disorder do not survive the correction, reductions in ADHD symptoms, opposition/defiance, and improvements in two measures of classroom behavior remain significant.

Finally, instead of considering twelve different post-treatment outcomes, we construct one overall index for children's socio-emotional and cognitive development.[25] This index is obtained by combining the twelve post-intervention measures shown in Table 5 in the following way: first, we negate the sign on all "positive outcomes," that is, grades, admission test scores, and prosociality to align their interpretation with the other negative socio-emotional outcomes.[26] Second, we average across these twelve standardized measures. Third, we standardize the resulting super-index. Last, we once again negate the index to obtain a measure capturing productive child development. Table 6 shows that the PATHS treatment significantly increases the post-intervention child development super-index (p-value = 0.021). Taken together, our results remain robust with respect to multiple hypothesis testing.

8. Comparison of Costs, Benefits, and Previous Evaluations

In this section, we contextualize the main results of this study. We start with the discussion of other randomized control trials (RCTs) that evaluated the PATHS program. These studies focus on the short-term effects of PATHS on behavioral outcomes and do not analyze the long-term impacts. We then compare the size of the treatment effects and the cost of PATHS to related childhood interventions.

8.1 Previous Evaluations of PATHS

A few studies have evaluated the short-term effects of PATHS in settings where the program was randomly assigned. These studies suggest that PATHS improves socio-emotional skills, improves academic performance, and reduces aggressive behavior. Greenberg et al. (1995) show that PATHS increases vocabulary and emotional intelligence of second and third grade children in the United States. Schonfeld et al. (2015) find similar results and show that PATHS improves reading and math proficiency in primary school. This effect, however, disappears two years after the intervention. Crean and Johnson

[25] Note that the underlying assumptions and the interpretation of this super-index are not trivial. The index rests on the strong assumption that standardized measures for ADHD symptoms and non-aggressive conduct behavior can be aggregated in a linear additive fashion.
[26] Negation is obtained by multiplying variables by minus one.

(2013) examine the effect of PATHS on US elementary school students' aggressive behavior and find lower levels of aggressive behavior for treated students. The effect persists over two years after the intervention. Kam, Greenberg and Kusché (2004) evaluate PATHS in a sample of children with special needs living in the United States. They find positive effects on externalizing and internalizing behavior and reduced self-reported depressivity three years after the intervention. Riggs et al. (2006) show that PATHS fosters inhibitory control and leads to less disruptive behavior. While some of the results of previous evaluations are consistent with our evidence on underlying mechanisms, we find no evidence that the intervention reduced physical aggression in our setting.

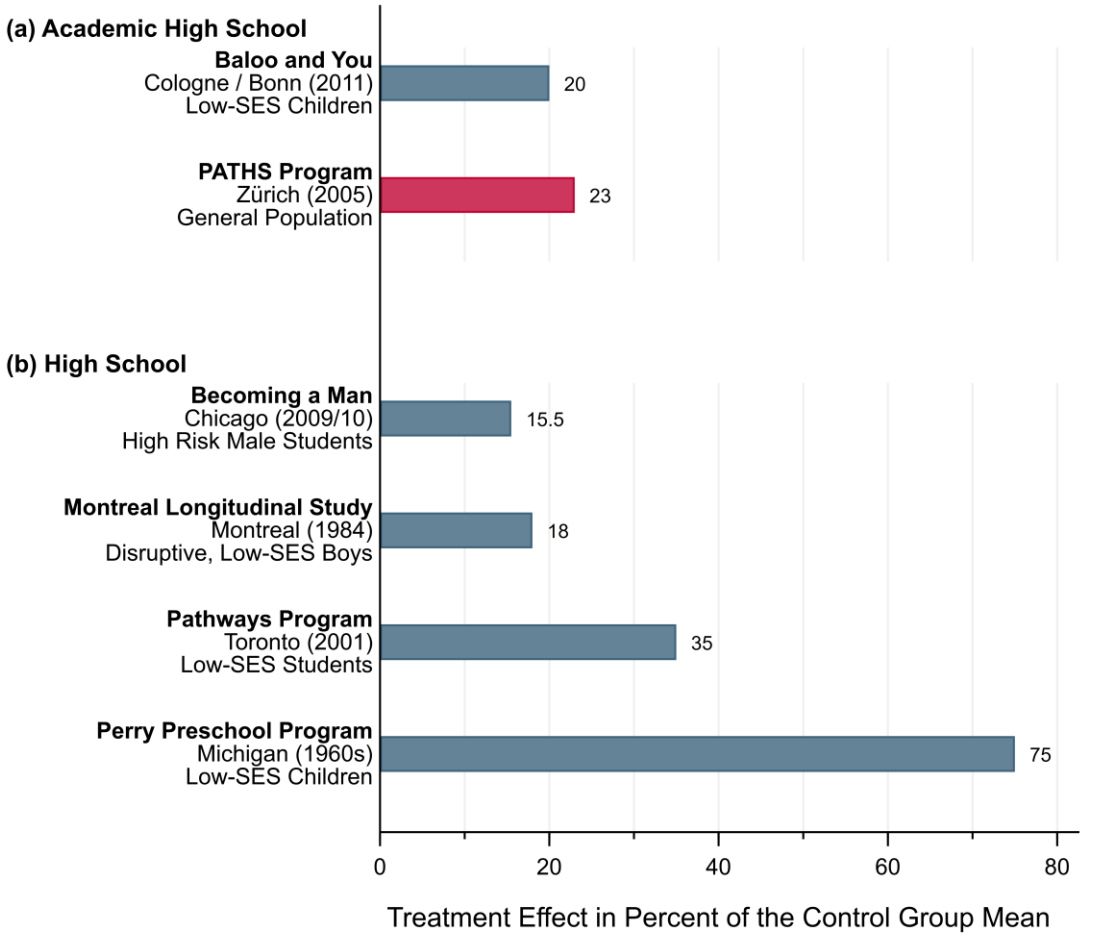
8.2 Comparison of Effect Size and Costs of Similar Interventions

In this section, we benchmark our intervention to similar interventions affecting educational outcomes and targeting child development. Figure 10 illustrates differences in effect sizes across studies.

In our setting, PATHS increases children's probability of completing academic high school by 23 percent. This effect size is comparable to effects of other interventions. The Montreal Longitudinal Study social skills training program increases the probability of completing high school by 13 to 18 percent (Boisjoli et al. 2007; Algan et al. 2016). The Becoming a Man intervention forecasts treatment effects of 12 to 19 percent on high school completion (Heller et al. 2017). The Pathways mentoring and tutoring program increases high school completion by 35 percent (Oreopoulos et al. 2017). The Baloo and You mentoring program increases the probability of getting tracked into academic high school by 20 percent (Falk et al., 2020). While Baloo and You and PATHS differ in their content, both interventions are similarly long (as measured in contact hours), target similarly aged children, and have almost identical treatment effects.

The effect of PATHS is substantially smaller than effects of US preschool programs. The PATHS effect is about one-quarter of the effect size of the Perry preschool program on high school completion (Barnett 1995; Heckman et al. 2010a) and about one-seventh of the effect of the Abecedarian program on college attendance (Campbell et al. 2014). These studies might find larger effects because they are more time- and resources-intensive and target disadvantaged populations.

Figure 10: Effect Size Comparison to Other Interventions



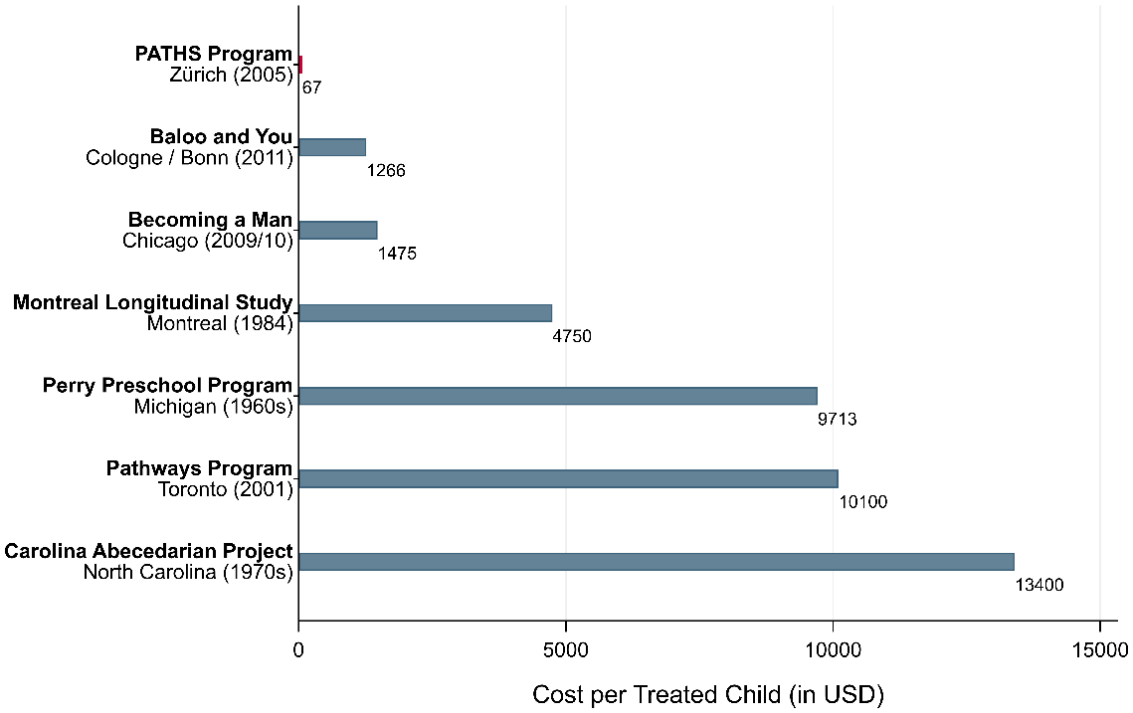
NOTE.—This figure shows treatment effect sizes for (academic) high school completion of different interventions in the related literature. The figure distinguishes between academic high school completion in Germany and Switzerland (panel a) and high school completion in the United States and Canada (panel b). The effect size for the Baloo and You program is reported in Falk et al. (2020). The effect size of the Perry Preschool Program is reported in Heckman et al. (2010a). The intervention effect size of the Montreal Longitudinal Study is reported in Algan et al. (2016). The effect size for the Becoming a Man intervention represents the midpoint of the range of 12 to 19 percent as provided in Heller et al. (2017). The effect size of the Pathways program is reported in Oreopoulos et al (2017).

We complement our effect size comparison with a comparison of costs. This comparison is difficult because information on costs is sometimes missing and sometimes, like in the case of teacher salaries, very context dependent. Therefore, the following analysis should be interpreted with caution.

Figure 11 shows the costs of interventions for which this information is available. The total intervention cost per child refers to all costs over the intervention period, excluding evaluation costs. These costs are in nominal USD. The implementation of PATHS in Zurich cost USD 1,540 per class and USD 67 per child. The main cost of

implementing PATHS stems from the teachers' training and the material for PATHS activities, for example, teaching folders, posters, books, and feeling cards. The Baloo and You intervention costs USD 1,266 per child (Baldauf and Péron, 2015). The Becoming a Man intervention costs USD 1,475 per child (Heller at al. 2017). The socio-emotional skills and parenting training implemented as part of the Montreal Longitudinal Study costs USD 4,750 per child (Algan et al. 2016). The Pathways mentoring and tutoring program costs USD 10,100 per child (Oreopoulos, Brown, and Lavecchia 2017). In light of their substantial treatment effects, all these interventions seem cost-effective. However, PATHS stands out as remarkably low-cost.

Figure 11: Cost Comparison with Other Interventions



NOTE.—This figure shows the cost per treated child of different interventions in the related literature. Cost estimates for the Becoming a Man, the Montreal Longitudinal Study, and the Carolina Abecedarian Projects intervention are taken from Heller at al. (2017), Algan et al. (2016), and Campell et al. (2014), respectively. Costs of the Perry Preschool Program are taken from the Web-Appendix of Heckman et al. (2010b). Cost estimates of the Baloo and You intervention in Germany are based on Baldauf and Péron (2015). Costs of the Pathways program are reported in Oreopoulos, Brown, and Lavecchia (2017).

PATHS is also substantially less expensive than early childhood education programs like the Perry Preschool Program or the Abecedarian project. The Perry Preschool Program costs USD 10,000 per child (Web-Appendix of Heckman et al. 2010b). The Abecedarian program costs USD 13,400 per child (Campbell et al. 2014). These

striking cost differences reflect that the Perry Preschool Program and the Abecedarian program are high-intensity interventions targeted at particularly disadvantaged populations.

To summarize, the comparison of effect sizes and costs suggests that PATHS is a low-cost intervention with substantial positive impacts. Our results suggest that embedding socio-emotional skills training programs as a general part of the standard primary school curriculum is a good investment.

9. Conclusion

This paper provides experimental evidence that fostering socio-emotional skills in primary school children has persistent positive effects on educational careers. We provide evidence on the PATHS program, a teacher-run intervention that lasts for up to two years in primary school. The intervention increases the probability of completing academic high school and enrolling in university twelve years after the end of the intervention.

Our results on underlying mechanisms suggest that the PATHS treatment effect is mainly driven by changes in some of the socio-emotional skills targeted by the intervention. Treated children become less impulsive, less disruptive, and display less opposition to teachers and parents. In class, treated children become less likely to disturb lessons and more likely to focus on the teaching content. Although we find that treated children have better grades, we find no evidence that standardized test scores are affected by the intervention. Long-term effects thus seem more likely to operate through changes in socio-emotional skills rather than cognitive skills.

One limitation of our study is the external validity of our results outside the Swiss context. Although over 60 percent of OECD countries use tracking policies similar to Switzerland's, it is unclear how much of the long-term effects we document are due to children being tracked only three years after the intervention. We do think, however, that the reduction in ADHD symptoms as well as improvements in classroom behavior and other socio-emotional skills are valuable in their own right, independent of the tracking system. Students, parents, and teachers benefit from these changes regardless of whether they lead students to a higher secondary school track. We hope that future studies will provide evidence on the labor market returns caused by the changes in socio-emotional skills we document in this paper. A second potential limitation of our study concerns the general equilibrium effects of the intervention. It is not clear whether we would observe the same treatment effects on tracking if the entire population were treated. Academic high

schools have capacity constraints and there is a strong belief in Switzerland that these schools should remain selective. It is therefore unclear whether a nationwide roll-out of the program would persistently increase overall university enrollment.

Taken together, the results of this study raise an interesting and policy-relevant question. Would it be possible to teach children socio-emotional skills with a subject that is explicitly dedicated to it, similar to the way math and reading are taught? While it has been shown that teachers have lasting impacts on behavior (Chetty el al. 2011, Jackson 2018), there is no school subject explicitly designed to foster socio-emotional skills. The results of this study suggest that primary schools are a promising place to institutionalize the training of socio-emotional skills.

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Tables

Table 1: Descriptive Statistics

	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
Educational Outcomes					
Attending Academic High School Age 13	1,589	0.157	0.364	0	1
Attending Academic High School Age 15	1,535	0.202	0.402	0	1
Attending Academic High School Age 17	1,305	0.261	0.439	0	1
Completed Academic High School Age 20	1,185	0.270	0.444	0	1
Enrolled in University Age 20	1,178	0.167	0.373	0	1
In Education or Training Age 20	1,178	0.565	0.496	0	1
Baseline Child Characteristics:					
Age in 2005	1,238	7.033	0.396	5.699	8.494
Swiss Citizenship	1,238	0.599	0.490	0	1
Female	1,675	0.481	0.500	0	1
Baseline Child Socio-Emotional Skills (Teacher Report):					
ADHD Symptoms (Disruptiveness and Impulsiveness)	1,348	1.246	0.989	0	4
Opposition & Defiance	1,348	0.541	0.815	0	4
Non-Aggressive Conduct Disorder	1,348	0.217	0.405	0	2.500
Anxiety & Depressivity	1,348	0.871	0.762	0	4
Overall Aggression	1,348	0.588	0.684	0	4
Prosociality	1,348	2.171	0.824	0	4
Baseline Child Socio-Emotional Skills (Parent Report):					
ADHD Symptoms (Disruptiveness and Impulsiveness)	1,229	1.212	0.646	0	3.778
Opposition & Defiance	1,229	0.966	0.621	0	2.750
Non-Aggressive Conduct Disorder	1,229	0.296	0.326	0	2.800
Anxiety & Depressivity	1,229	0.704	0.464	0	2.556
Overall Aggression	1,229	0.601	0.423	0	2.750
Prosociality	1,229	2.577	0.528	0.600	4
Baseline Parenting Practices (Parent Report):					
Corporal Punishment	1,229	0.454	0.489	0	2.667
Inconsistent Discipline	1,229	1.188	0.598	0	3.200
Parental Control & Supervision	1,229	3.686	0.328	2	4
Parental Involvement	1,229	3.189	0.422	1.500	4
Positive Parenting	1,229	3.215	0.514	1.200	4
Baseline Household Characteristics:					
Mother Completed at least *Gymnasium* Degree	1,215	0.393	0.489	0	1
Father Completed at least *Gymnasium* Degree	1,015	0.518	0.500	0	1
Mother Holds University Degree	1,215	0.160	0.367	0	1
Father Holds University Degree	1,015	0.249	0.433	0	1
Single-Parent Household	1,230	0.172	0.378	0	1
Age Mother in 2005	1,218	37.02	5.375	23	53
Mother Swiss Citizenship	1,663	0.486	0.500	0	1
Mother Born in Switzerland	1,219	0.423	0.494	0	1
Family Receives Financial Aid	1,213	0.380	0.486	0	1
Family Reports Financial Problems	1,216	0.178	0.382	0	1
Household Income (in 1000 USDs)	1,132	86.31	48.71	12	270

NOTE.—This table shows descriptive statistics for the variables used in our analysis. SD stands for standard deviation.

Table 2: Summary Table for Balancing of Baseline Characteristics

	(1) Number of Balancing Tests	(2) Expectation under Random Assignment
Total Number of Balancing Tests	56	
Number of Tests Significant with p<0.01	1	0.560
Number of Tests Significant with p<0.05	2	2.800
Number of Tests Significant with p<0.1	5	5.600

NOTE.—This table summarizes the results of our balancing tests. To test random assignment, we regress treatment status on baseline characteristics. We run a separate linear probability model for each baseline characteristic. Table 3 shows a detailed list of all baseline characteristics and individual point estimates. All regressions include strata fixed effects for the level of randomization. Standard errors are clustered at the school level. Column (1) reports the total number of balancing tests and the number of statistically significant tests for different levels of significance. Column (2) reports the number of coefficients we would expect to be statistically significant due to chance under random assignment.

Table 3: Balancing Tests of Baseline Characteristics

Panel A: PATHS Treatment	(1)		(2)		(3)		(4)
Child and Household Characteristics	PATHS	SBQ (Parent Report)	PATHS	SBQ (Teacher Report)	PATHS	SBQ (Child Report)	PATHS
Age in 2005	-0.013	Prosociality	0.004	Prosociality	0.056**	Prosociality	-0.004
	(0.042)		(0.013)		(0.027)		(0.016)
Female	0.036*	Anxiety & Depressivity	0.009	Anxiety & Depressivity	0.035	Anxiety & Depressivity	0.009
	(0.020)		(0.014)		(0.021)		(0.013)
Swiss Citizenship	0.036	ADHD Symptoms (Disruptiveness and Impulsiveness)	-0.004	ADHD Symptoms (Disruptiveness and Impulsiveness)	0.035	ADHD Symptoms (Disruptiveness and Impulsiveness)	0.014
	(0.045)		(0.012)		(0.021)		(0.014)
Mother Holds University Degree	-0.049	Opposition & Defiance	-0.022*	Opposition & Defiance	0.029	Opposition & Defiance	0.013
	(0.045)		(0.013)		(0.024)		(0.013)
Father Holds University Degree	-0.073	Non-Aggressive Conduct Disorder	0.000	Non-Aggressive Conduct Disorder	0.008	Non-Aggressive Conduct Disorder	-0.009
	(0.044)		(0.012)		(0.019)		(0.011)
Mother Completed at least *Gymnasium* Degree	-0.049	Non-Aggressive Externalizing Problem Behavior	-0.016	Non-Aggressive Externalizing Problem Behavior	0.020	Non-Aggressive Externalizing Problem Behavior	0.005
	(0.035)		(0.013)		(0.022)		(0.012)
Father Completed at least *Gymnasium* Degree	-0.099***	Indirect Aggression	0.016	Indirect Aggression	0.029	Indirect Aggression	0.022
	(0.032)		(0.013)		(0.020)		(0.014)
Single Parent Household	0.004	Reactive Aggression	0.000	Reactive Aggression	0.018	Reactive Aggression	0.002
	(0.029)		(0.012)		(0.026)		(0.013)
Age Mother in 2005	0.003	Physical Aggression	-0.005	Physical Aggression	0.001	Physical Aggression	0.009
	(0.003)		(0.015)		(0.021)		(0.014)
Mother Swiss Citizenship	0.029	Proactive Aggression & Dominance	-0.008	Proactive Aggression & Dominance	0.029	Proactive Aggression & Dominance	0.023*
	(0.039)		(0.013)		(0.021)		(0.012)
Mother Born in Switzerland	0.017	Overall Aggression	-0.005	Overall Aggression	0.017	Overall Aggression	0.013
	(0.036)		(0.014)		(0.023)		(0.014)
Family Receives Financial Aid	-0.031	Overall Externalizing Behavior	-0.009	Overall Externalizing Behavior	0.029	Overall Externalizing Behavior	0.013
	(0.028)		(0.013)		(0.024)		(0.014)
Family Reports Financial Problems	-0.009	Overall Behavior Score 1	-0.002	Overall Behavior Score 1	0.017	Overall Behavior Score 1	0.016
	(0.043)		(0.014)		(0.025)		(0.015)
Household Income (in 1000 USDs)	0.000	Overall Behavior Score 2	-0.010	Overall Behavior Score 2	-0.011	Overall Behavior Score 2	0.011
	(0.000)		(0.014)		(0.024)		(0.015)

NOTE.—This table shows the coefficients from 56 separate OLS regressions testing whether a characteristic predicts treatment status. In panel A, the treatment indicator PATHS is regressed on one baseline variable, while in panel B, a treatment indicator for Triple P is regressed on one baseline variable. Baseline variables include all available child, parental, and household characteristics and baseline child SBQ measures. All models include strata fixed effects for the level of randomization. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Treatment Effects of PATHS on Educational Outcomes Over Time

Panel A: No Controls	(1) Attending Academic High School Age 13	(2) Attending Academic High School Age 15	(3) Attending Academic High School Age 17	(4) Completed Academic High School (Self-Reported)	(5) Enrolled in University (Self-Reported)
PATHS Treatment	0.006	0.018	0.033	0.023	0.018
	(0.018)	(0.023)	(0.028)	(0.030)	(0.020)
Randomization Inference *p*-value	0.752	0.361	0.161	0.347	0.403
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.072	0.091	0.106	0.107	0.084
Control Group Mean Dependent Variable	0.163	0.204	0.256	0.269	0.168
Randomization Controls	No	No	No	No	No
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8
Panel B: Randomization Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS Treatment	0.023*	0.041**	0.060***	0.051**	0.036**
	(0.013)	(0.016)	(0.018)	(0.021)	(0.016)
Randomization Inference *p*-value	0.165	0.020	0.005	0.026	0.075
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.224	0.287	0.299	0.265	0.176
Control Group Mean Dependent Variable	0.163	0.204	0.256	0.269	0.168
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8
Panel C: Full Set of Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS Treatment	0.044**	0.062***	0.067***	0.071***	0.040*
	(0.020)	(0.017)	(0.019)	(0.021)	(0.023)
Randomization Inference *p*-value	0.048	0.010	0.009	0.012	0.121
Observations	1,011	997	900	837	833
R-squared	0.303	0.368	0.395	0.364	0.247
Control Group Mean Dependent Variable	0.199	0.252	0.303	0.308	0.191
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows the treatment effect of the PATHS intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20.

All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. In Panel A, we do not include any controls for baseline characteristics. In Panel B, we include randomization controls for mother's and father's education level. In Panel C, we include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. Child controls include the age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. The table also shows *p*-values based on randomization inference with 10,000 replications. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Multiple Hypothesis Testing I

Dependent Variable:	(1) Standardized Grade	(2) Standardized Admission Test Score	(3) ADHD	(4) Opposition/ Defiance	(5) NACD	(6) Anxiety/ Depressivity	(7) Aggression	(8) Prosociality	(9) Disturbs Lessons	(10) Busy with Other Things in Class	(11) Impertinent Conduct at School	(12) Neglects Homework
PATHS Treatment	0.242*	0.054	-0.154***	-0.148***	-0.136**	0.054	-0.039	-0.017	-0.172***	-0.161***	-0.095	-0.021
Original *p*-value	0.096	0.651	0.001	0.005	0.034	0.333	0.556	0.778	0.002	0.003	0.118	0.658
Bonferroni-Holm corrected *p*-value	0.671	1.000	0.011	0.049	0.268	1.000	1.000	1.000	0.022	0.027	0.709	1.000
Bonferroni corrected *p*-value	1.000	1.000	0.011	0.066	0.403	1.000	1.000	1.000	0.025	0.032	1.000	1.000
Observations	364	375	1,035	1,035	1,035	1,035	1,035	1,035	1,034	1,034	1,034	1,034
R-squared	0.544	0.600	0.502	0.358	0.376	0.244	0.400	0.368	0.387	0.379	0.239	0.297
Control Group Mean Dependent Variable	.01	.074	.03	.041	-.003	-.082	-.034	.016	.024	.06	-.005	-.022
Randomization Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IP-Weighting	Yes	Yes	No	No	No	No	No	No	No	No	No	No

NOTE.—This table shows the treatment effect of the PATHS intervention on cognitive and socio-emotional outcomes. Standardized grade corresponds to the teacher-given, primary school grades obtained before taking the academic high school admission test. Estimates for admission test scores are based on the score obtained from the first time taking the test. Admission to academic high school is possible after Grade 6, 8, and 9. The first two regressions are based on inverse probability weighting, with weights constructed by regressing an indicator for whether we observe any grade or test score on the full set of controls except child SBQ, and then taking the square of the inverse predictions. Columns (3)–(8) show the treatment effect for socio-emotional outcomes and columns (9)–(12) for classroom behavior. The outcomes in columns (3)–(12) are averaged over survey waves and then standardized across the sample. We include Bonferroni and Bonferroni-Holm *p*-values to perform multiple hypotheses testing. All models include strata fixed effects for the level of randomization. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Multiple Hypothesis Testing II

Dependent Variable	(1) Overall Socio-Emotional and Cognitive Outcomes
PATHS Treatment	0.119**
	(0.050)
p-value	0.021
Observations	1,036
R-squared	0.466
Control Group Mean Dependent Variable	.001

NOTE.— The outcome variable is an index created by taking the mean over all twelve outcomes in Table 5 and then standardizing across the sample. Before taking the mean, we first reverse the sign on all "positive outcomes," that is, grade, admission test score, and prosociality. In doing so, we flip the interpretation from good to bad. After the estimation, we remove the minus on the resulting coefficient, in order to once again represent the results with a positive interpretation. All models include strata fixed effects for the level of randomization. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

The Causal Impact of Socio-Emotional Skills Training on Educational Success

Giuseppe Sorrenti, Ulf Zölitz, Denis Ribeaud, Manuel Eisner

Appendix Section A1: Supplementary Tables and Figures

Table A1: PATHS Activities

Activity Category	Example Activities		
	Class Activity:	Homework:	Parental Involvement:
Self-Control; Patience	**Calming down:** Teacher discusses with class various methods to calm down. Teacher reads aloud story of a girl who learned how to control herself. **Teasing**: Children learn to ignore people who tease in a mean way. Children make role-plays to learn how to interpret and handle teasing.	**Calming down**: Children write what their parents do when they have a problem or want to calm down.	**Calming down**: Children ask their parents about situations in which they had to calm down and had to think about a possible solution.
Social Problem Solving	**Control signals**: Children learn the three steps of problem solving: 1. Calm down and express own feelings. 2. Think about possible solutions and their consequences. 3. Try the plan and evaluate it. Children make role-plays to practice the problem solving steps. **Problem pot**: If children have problems, they can write them down and put them in the problem pot. The class will then try to solve these problems with the help of the control signals and role-playing. **Generosity**: Class plans a project to somehow help others (e.g. raise money or clean up neighborhood).	**Control signals**: Children have to make their own control signals. **Generosity**: Children should do something good for a person and draw/write about it.	**Control signals**: Parents receive an explanation about when and how they could use the control signals.
Self-Esteem	**Child of the week:** In each PATHS lecture a child is randomly picked to be the teacher's assistant during the lecture. Further, the other children make a list of compliments for the child of the week. Before that, the children learn how to compliment another person.	**Compliments**: Children have to give compliments to other members of their families and reflect on how they felt giving compliments and how the other person reacted.	**Child of the week/ compliments:** Parents are informed that their child is the child of the week. They go through the list of compliments with their child and add compliments.
Emotional Intelligence	**Emotions**: Children get introduced to and discuss various emotions. Teacher tells a story about or shows picture of people, and children have to guess how the person in the story/in the picture felt in this situation. Child choses an emotion and the other children try to mimic the emotion.	**Emotions**: Children draw a picture or write about a situation in which they felt a certain emotion.	**Emotions/appropriate behavior**: Children ask their parents or other adults to tell them about a situation in which they felt a certain emotion and how they behaved.

Table A1: PATHS Activities (continued)

Emotional Intelligence (Continued)	**Feelings cards**: Children receive cards with faces expressing different emotions. Children can place a card on their table to express their current emotional state. **Appropriate behavior:** Children are given drawings of children behaving out of an emotion (e.g., anger). They then have to color the drawings in which they think the behavior is appropriate.		
Fairness Rules	**Classroom rules**: Children discuss with teacher why rules are useful and establish a set of rules for their classroom. **Making friends:** Teacher reads aloud story to class about two children becoming friends. After, discussion and role-play about friendship and making friends. **Listening to others:** In groups, children learn to listen to each other to gather information about the members of their group. **Manners**: Classroom discussion about good/bad manners and why good manners are important. Children gather polite phrases and expressions. Teacher reads a story and children have to decide in each situation whether the teacher reads the polite or impolite version. Afterwards, children reenact the situation. **Fairness**: Teacher introduces poster with principles of fair behavior. Children hear stories/get worksheet with different situations and discuss in groups whether the displayed behavior is fair or not. Children establish ideas on how to make fair decisions (e.g. coin toss). **Reconciliation**: Children gather ideas and make a list of ways to reconcile.	**Rules at home**: Children have to establish a list with the rules that apply in their home.	**Rules**: Children have to interview their parents about the rules that applied in their home when they were children themselves. **Manners**: Parents should discuss with children good/bad manners and how they feel when the child shows bad manners at home.

NOTE.—This table provides an overview of the main themes of the PATHS curriculum. Besides classroom activities, children also received homework, which may have involved parents. All major themes of the PATHS curriculum were accompanied with an information leaflet for parents explaining the current theme and providing suggestions on how to support children with the current curricular activities.

Table A2: Overview of the z-proso Study Survey Waves

Year	2004/5	2006	2007	2008	2009	2010	2011	2013	2015	2018
Wave	1	2	3	4.1	4.2	4.3	5	6	7	8
Age	7	8	9	10	11	12	13	15	17	20
Grade	2	3	4	5	6	7	8	10	(12)	-
Respondents:										
Teacher	✓	✓	✓	✓	✓	✓	✓	✓	(✓)	✗
Child	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓
Parent	✓	✓	✓	✗	✓	✗	✗	✗	✗	✗
Response Rate:										
Teacher	80.54%	80.54%	77.19%	75.70%	63.46%	58.27%	75.70%	77.13%	53.91%	✗
Child	81.07%	79.58%	78.86%	✗	68.48%	✗	81.49%	86.32%	77.91%	70.45%
Parent	99.94%	71.10%	70.45%	✗	64.06%	✗	✗	✗	✗	✗

NOTE.—The table shows the timing, respondents, and response rates of the different survey waves of the z-proso study. Age refers to the median child age in the respective survey wave. The table also shows which respondents took part in the respective survey wave. In wave 1, parents had already been surveyed in 2004. In our analysis, we do not use teacher assessments at age 17 since individuals outside academic high school do not have a regular school teacher who could provide a valid assessment at this age.

Table A3: Treatment Effects of PATHS on Educational Outcomes Over Time – Full Set of Controls (Imputed)

	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS Treatment	0.023*	0.040***	0.056***	0.051**	0.028
	(0.013)	(0.014)	(0.017)	(0.020)	(0.017)
Randomization Inference *p*-value	0.155	0.022	0.006	0.050	0.171
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.287	0.349	0.374	0.332	0.232
Control Group Mean Dependent Variable	.163	.204	.256	.269	.168
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table supplements Table 4, Panel C, showing the treatment effect of the PATHS intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. Similar to Panel C, we include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. In this table, however, we impute missing controls by assigning the overall sample mean to each observation with missing information for a continuous control variable and a new missing category to each observation with missing information for an indicator variable. We also include indicator variables for whether a variable is imputed. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. The table also shows *p*-values based on randomization inference with 10,000 replications. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Test for Selective Attrition

Panel A: Outcomes Observed?	(1) Tracking Outcome Observed at Age 13	(2) Tracking Outcome Observed at Age 15	(3) Tracking Outcome Observed at Age 17	(4) Completion of Academic High School Observed	(5) Enrollment in University Observed
PATHS Treatment	0.017	0.011	0.001	0.012	0.012
	(0.011)	(0.015)	(0.021)	(0.019)	(0.019)
Observations	1,675	1,675	1,675	1,675	1,675
R-squared	0.012	0.029	0.063	0.090	0.089
Control Group Mean Dependent Variable	0.94	0.91	0.783	0.711	0.707
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

Panel B: Outcomes & Control Variables Observed?	Control Variables Observed at Age 13	Control Variables Observed at Age 15	Control Variables Observed at Age 17	Control Variables Observed at Academic High School Completion	Control Variables Observed at Enrollment in University
PATHS Treatment	-0.035	-0.032	-0.035	-0.009	-0.011
	(0.025)	(0.025)	(0.027)	(0.030)	(0.030)
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.040	0.041	0.046	0.048	0.050
Control Group Mean Dependent Variable	0.231	0.272	0.355	0.345	0.224
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows the treatment effect of the PATHS intervention on the probability of observing a student's educational outcome at ages 13, 15, 17, and 20. We estimate linear probability models. The dependent variables in Panel A are indicator variables for observing the respective educational outcome. The dependent variables in Panel B are indicator variables for observing the respective educational outcome and baseline covariates. All models include strata fixed effects for the level of randomization. Panel A includes randomization controls for mother's and father's education level. The point estimates for the *PATHS Treatment* indicate whether the treatment has an effect on attrition. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Main Results using an Index Measure and Pooled Regression

Panel A: Index Measure	(1) Weighted Education Index	(2) Weighted Education Index	(3) Weighted Education Index	(4) Weighted Education Index
PATHS Treatment	0.041	0.090**	0.142***	0.087**
	(0.052)	(0.035)	(0.050)	(0.036)
Observations	1,615	1,615	1,034	1,615
R-squared	0.108	0.280	0.365	0.339
Control Group Mean Dependent Variable	0.01	0.01	0.115	0.01
Randomization controls	No	Yes	Yes	Yes
Additional controls	No	No	Yes	Yes
Imputed controls	No	No	No	Yes
Survey Wave Fixed Effects	No	No	No	No
Panel B: Pooled Regression	Pooled Regression	Pooled Regression	Pooled Regression	Pooled Regression
PATHS Treatment	0.019	0.041**	0.056***	0.039**
	(0.018)	(0.016)	(0.021)	(0.015)
Observations	6,792	6,792	4,578	6,792
R-squared	0.101	0.253	0.327	0.309
Control Group Mean Dependent Variable	0.21	0.21	0.249	0.21
Randomization Controls	No	Yes	Yes	Yes
Additional Controls	No	No	Yes	Yes
Imputed Controls	No	No	No	Yes
Survey Wave Fixed Effects	Yes	Yes	Yes	Yes

NOTE.—This table shows the treatment effect of the PATHS intervention on aggregated outcomes measuring the educational success of children through ages 13, 15, 17, and 20. In Panel A, the dependent variable is a weighted covariance index following Anderson (2008) based on indicator variables for the attendance of academic high school at ages 13, 15, and 17 as well as for the probability of completing academic high school and being enrolled in university at age 20. In Panel B, the sample is reshaped to a panel format with the educational outcomes measured at ages 13, 15, 17, and 20 as pooled dependent variables. All models include strata fixed effects for the level of randomization. Randomization controls include indicator variables for mother's and father's education level. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Robust standard errors clustered at the school (individual) level for Panel A (Panel B) are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A6: Main Results with Alternative Treatment Definition—Excluding All Children Receiving the Triple P Intervention

Panel A: Randomization Controls	(1) Attending Academic High School Age 13	(2) Attending Academic High School Age 15	(3) Attending Academic High School Age 17	(4) Completed Academic High School (Self-Reported)	(5) Enrolled in University (Self-Reported)
PATHS Treatment	0.043**	0.070***	0.058**	0.074**	0.039*
	(0.021)	(0.021)	(0.024)	(0.032)	(0.022)
Observations	819	798	674	616	613
R-squared	0.257	0.295	0.314	0.295	0.208
Control Group Mean Dependent Variable	0.182	0.213	0.294	0.295	0.191
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

Panel B: Full Set of Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS Treatment	0.068**	0.089***	0.041**	0.074***	0.025
	(0.027)	(0.020)	(0.019)	(0.021)	(0.027)
Observations	560	551	489	458	456
R-squared	0.358	0.379	0.435	0.404	0.333
Control Group Mean Dependent Variable	0.231	0.272	0.355	0.345	0.224
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows the treatment effect of the PATHS intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. The estimation sample in this table includes only the control group and the treatment group that received the PATHS intervention. All children who received the Triple P intervention are excluded. All models include strata fixed effects for the level of randomization. In Panel A, we include randomization controls for mother's and father's education level. In Panel B, we include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Main Results with Inverse Probability Weighting

	(1)	(2)	(3)	(4)	(5)
	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS Treatment	0.044**	0.061***	0.061***	0.066***	0.035
	(0.020)	(0.017)	(0.019)	(0.020)	(0.022)
Observations	1,011	997	900	837	833
R-squared	0.306	0.366	0.396	0.366	0.245
Control Group Mean Dependent Variable	0.199	0.252	0.303	0.308	0.191
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows the treatment effect of the PATHS intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. Models are identical to the regressions in Table 4, Panel C, but use inverse probability weights to account for attrition. Inverse probabilities are based on predicted values from the model estimating attrition using the full set of controls. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A8: Probability of Taking Academic High School Admission Test

Panel A: Randomization Controls	Taking Admission Test			
	Any	Age 12	Age 14	Age 15
PATHS Treatment	0.027	0.041*	-0.001	0.006
	(0.022)	(0.021)	(0.013)	(0.012)
Observations	1,675	1,675	1,675	1,675
R-squared	0.153	0.153	0.009	0.013
Control Group Mean Dependent Variable	0.316	0.262	0.096	0.055
Randomization Controls	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No

Panel B: Full Set of Controls	Taking Admission Test			
	Any	Age 12	Age 14	Age 15
PATHS Treatment	0.002	0.020	-0.014	0.009
	(0.025)	(0.025)	(0.015)	(0.015)
Observations	1,093	1,093	1,093	1,093
R-squared	0.200	0.199	0.012	0.011
Control Group Mean Dependent Variable	.367	.31	.103	.057
Randomization Controls	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes

NOTE.—The table shows the effect of the treatment on taking the academic high school admission test. We estimate linear probability models. Taking the admission test is possible at the three times. Column 1 shows the effect of ever taking the admission test. Columns (2)–(4) show the effect by grade. Panel A includes randomization controls for mother's and father's education level. Panel B includes controls for baseline child, parental, and household characteristics and the baseline child SBQ measures. All models include strata fixed effects. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure A1: Example Material from Intervention I

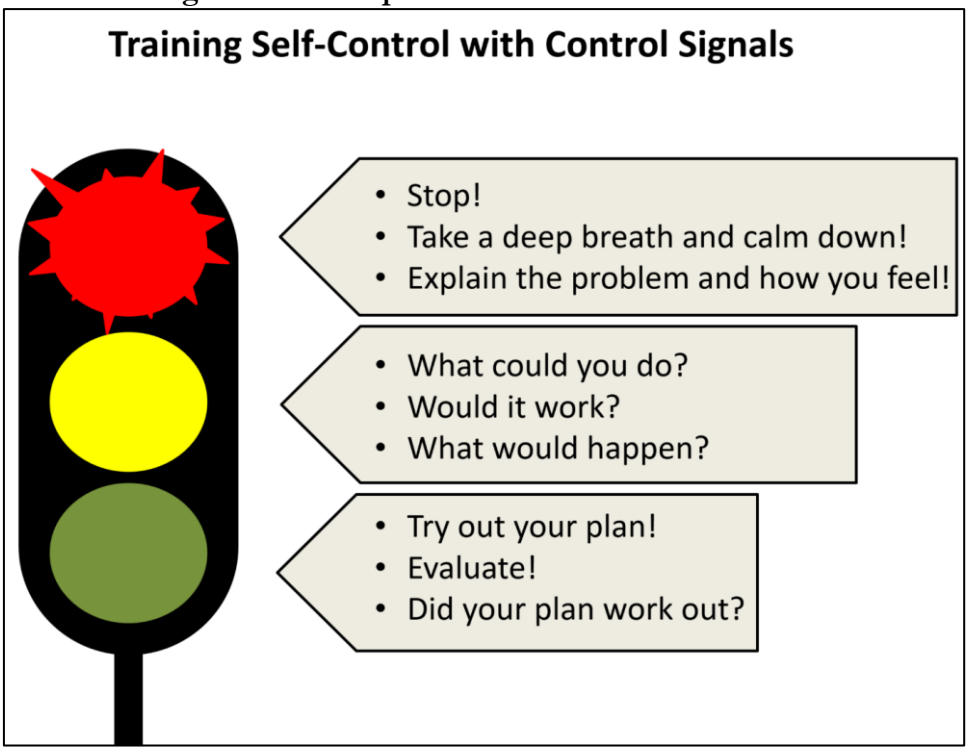
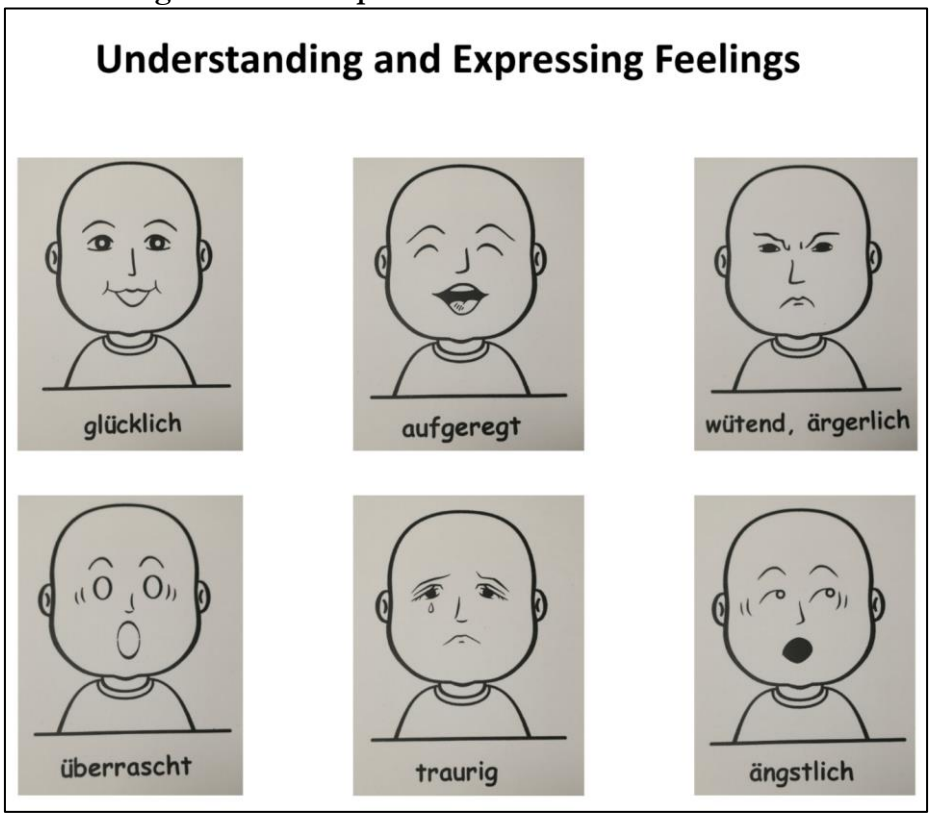


Figure A2: Example Material from Intervention II

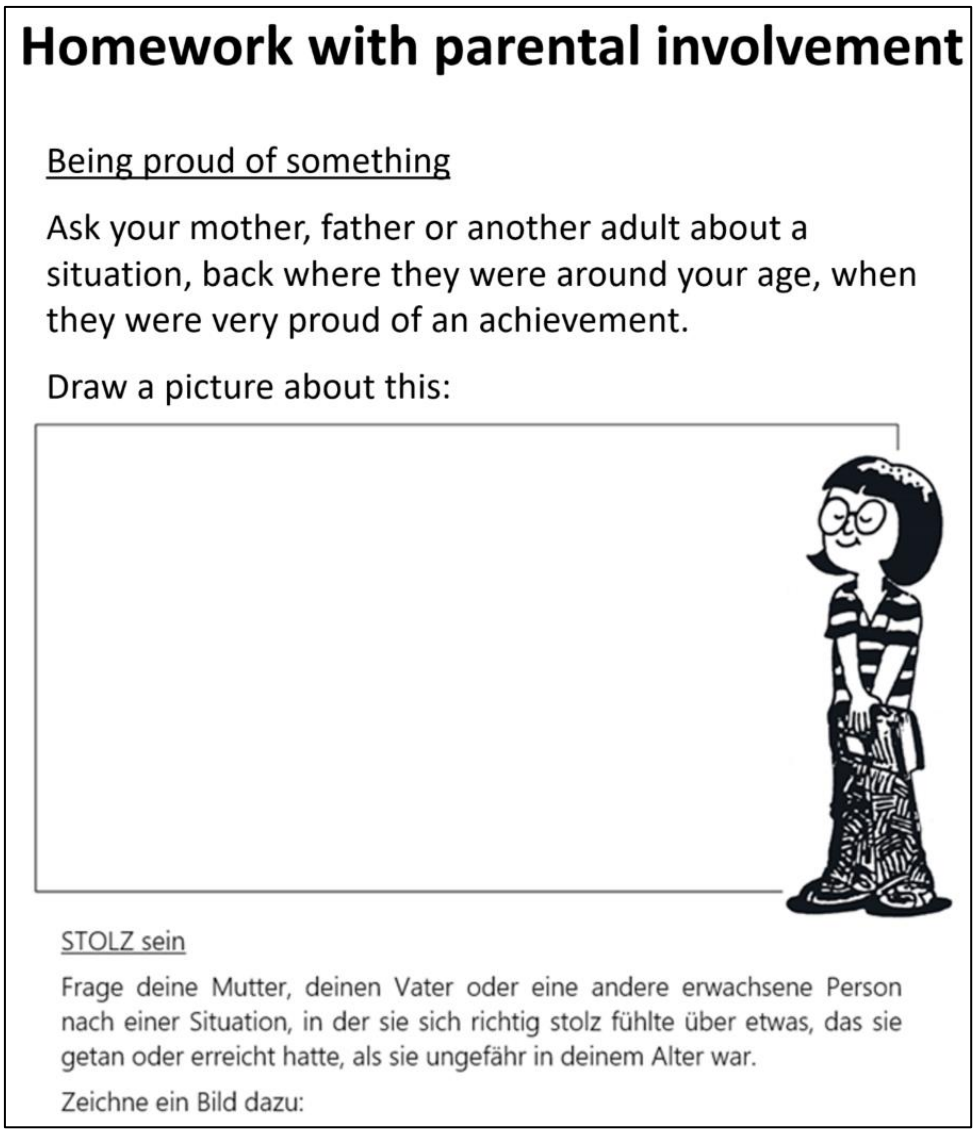


NOTE.—Children use feeling cards to explain their own and other people's behavior, reactions, and feelings. Translation: happy, excited, angry, surprised, sad, worried.

Figure A3: Example Material from Intervention III
Fairness and Rules: Recognizing Aggression & Unacceptable Behavior

NOTE.—Instructions for children: Color all pictures showing a behavior that is okay.

Figure A4: Example Material from Intervention IV



Homework with parental involvement

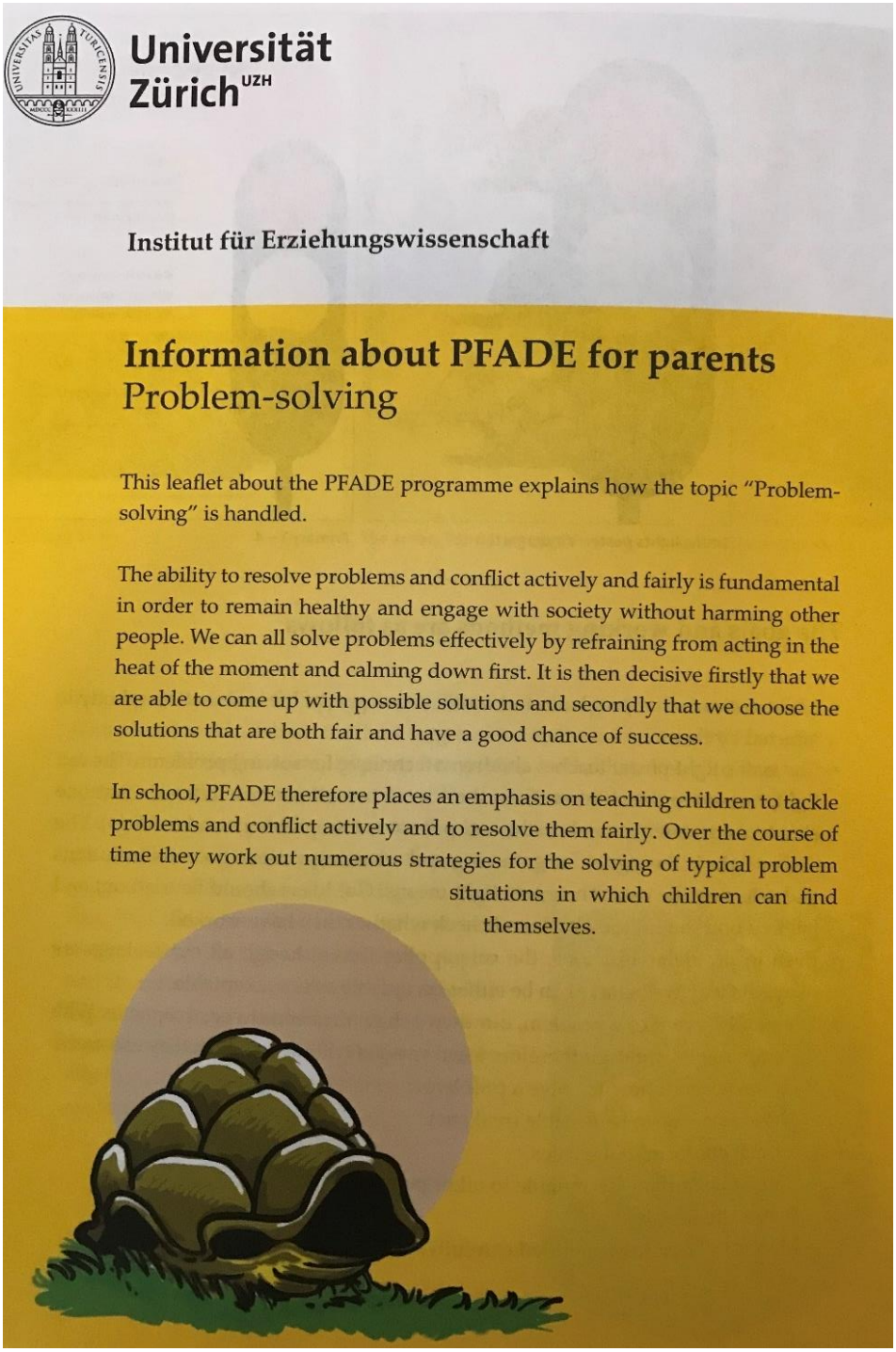
Being proud of something

Ask your mother, father or another adult about a situation, back where they were around your age, when they were very proud of an achievement.

Draw a picture about this:

Figure A5: Example Material from Intervention V

Information Leaflet for Parents (a)



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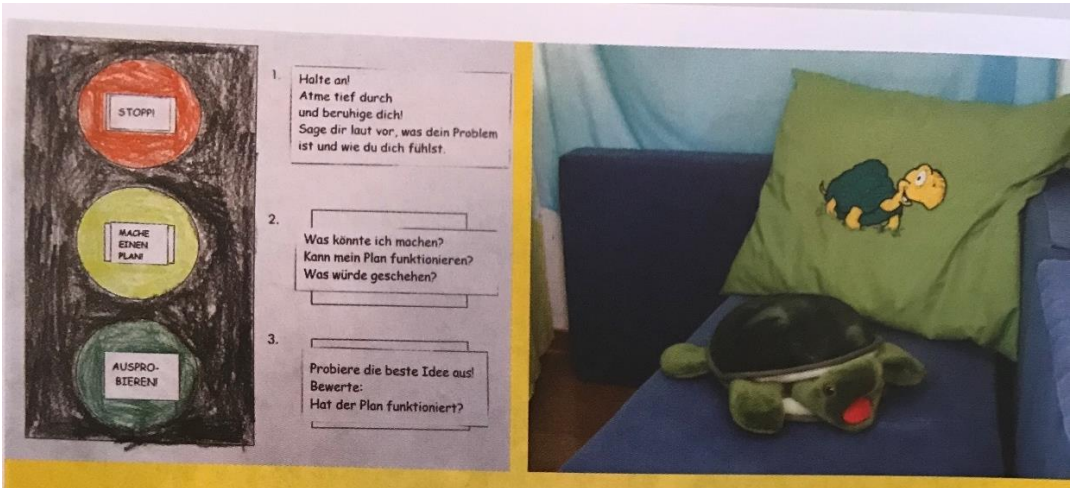
Information about PFADE for parents
Problem-solving

This leaflet about the PFADE programme explains how the topic "Problem-solving" is handled.

The ability to resolve problems and conflict actively and fairly is fundamental in order to remain healthy and engage with society without harming other people. We can all solve problems effectively by refraining from acting in the heat of the moment and calming down first. It is then decisive firstly that we are able to come up with possible solutions and secondly that we choose the solutions that are both fair and have a good chance of success.

In school, PFADE therefore places an emphasis on teaching children to tackle problems and conflict actively and to resolve them fairly. Over the course of time they work out numerous strategies for the solving of typical problem situations in which children can find themselves.

Information Leaflet for Parents (b)



What you can do at home to support your child:

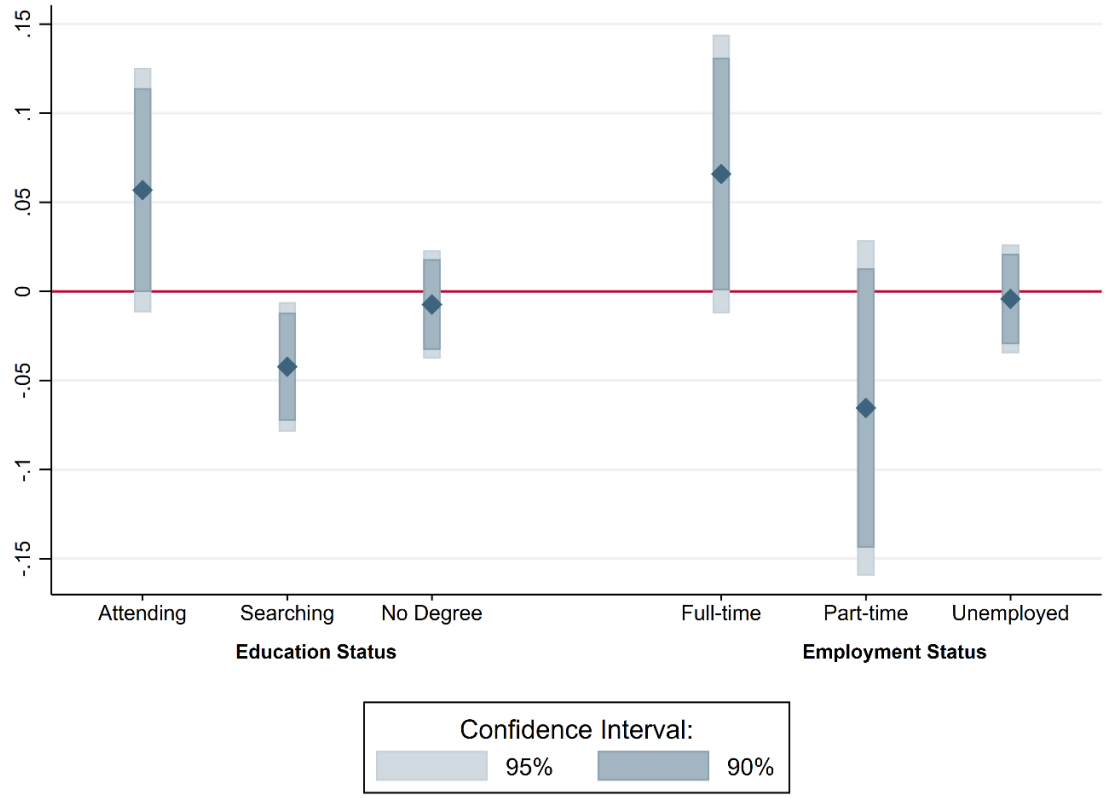
- Ask your child whether there is a problem when he or she seems despondent, sad or annoyed.
- If the answer is yes, remind your child of the amber light. Say, for example: "Remember the amber light! Let's think about this. What could you do?" With your child, gather ideas for resolving the problem and if necessary, help him or her to do this. Think together about which idea is the best (feasible, conforming to the rules, fair, healthy).
- Ask later whether your child was successful in resolving the problem. If not, try to come up with further ideas together.
- If you yourself have a problem or conflict with your children, talk about the problem and your feelings. Using the traffic light model, proceed to the amber light and gather problem-solving ideas with your child. Think together about which is the best idea. Proceed to the green light and make a decision. After a while, check whether the problem has been resolved. If not, look for further ideas and try out another one.

Information Leaflet for Parents (c)

What you can do at home to support your child:

- Talk to your child about the TOP technique and ask what strategies he or she has learned through it.
- Organisation and planning also relate specifically to the time your child spends at home and in other places outside the classroom. Support your child in looking after the necessary materials and help him or her to have a tidy, quiet place for their school things and for studying.
- Help him or her to apportion their out-of-school time sensibly so that studying is completed in good time and where necessary in several sessions but also in order to ensure that relaxation has its place.
- Encourage your child to develop a strong motivation for school and schoolwork and to put in the appropriate amount of effort.

Figure A6: Treatment Effects on Employment and Education Status at Age 20



NOTE.—The figure shows the treatment effect of the PATHS intervention on employment and education status at age 20. Employment outcomes are conditional on not participating in any education or training. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. All models include randomization controls for mother's and father's education level as well as controls for baseline child, parental, and household characteristics and the baseline child SBQ measures. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

Appendix Section A2: Data Collection and Survey Procedures

Ribeaud et al. (2022) provide a detailed description of the Zurich Project on the Social Development from Childhood to Adulthood (z-proso). In each of the 56 selected schools, all children entering Grade 1 in 2004 were invited to participate in the first survey wave via their parents, providing a target sample of 1,675 children. For the data collection of waves 1–3 at ages 7, 8, and 9, we obtained informed consent from the parents of participating children, which we renewed for the data collection in wave 4 at age 11. From wave 5 (age 13) onward, the participants themselves provided direct informed consent, though parents retained the right to opt their child out of the study. Informed consent by the youths was renewed at wave 7 (age 17) and wave 8 (age 20).

z-proso entails four main types of data collection, specifically, parent, teacher, child, and youth surveys. Parent interviews at child age 7, 8, 9, and 11 were usually carried out at the mothers' home using computer-aided personal interviews (CAPI). Given the highly multicultural population in Zurich, the standardized interviews were conducted by specially trained native speakers in nine different languages: German, Albanian, Bosnian/Croatian/Serbian, Portuguese, Spanish, Italian, Turkish, Tamil, and English. The interviews typically took about an hour and participating parents received vouchers worth USD 20–50 as participation incentives.

Teachers of all participating children were invited to complete postal surveys at ages 7, 8, 9, 10, 11, 12, 13, 15, and 17. The teacher survey consisted of a one-page form related to each participant in the teacher's class that took five to ten minutes to complete, plus a questionnaire at the level of the class and of the schoolhouse, which took five to ten minutes to complete. In the first three years, participation was mandatory for all teachers. After that, teachers who had to complete more than seven questionnaires were offered book vouchers worth about USD 50 as a participation incentive.

Specially trained interviewers conducted standardized computer-assisted child interviews (CAPI) at ages 7, 8, and 9 during regular school lessons (45 minutes). These surveys were specially designed for the age group and were mostly play-based. At ages 11, 13, 15, and 17 we changed the methodology to classroom-based paper-and-pencil questionnaires. Two or three research assistants conducted the survey sessions, which lasted 60 to 90 minutes. At age 11, the surveys were conducted during regular school lessons. For later waves, surveys took place during leisure time and were incentivized with the equivalent of USD 30–60 in cash. At age 20, the survey was based on essentially the same instrument as in previous waves, but was administered in a central university computer lab using computer-assisted self-interview (CASI) methodology. The participation incentive increased to USD 75.

All data collections were in accordance with the Swiss data protection and human research acts. The most recent review by the Ethics Committee of the Faculty of Arts and Social Sciences of the University of Zurich took place in early 2018.

Appendix Section A3: The Triple P Intervention: Description and Analyses

Triple P is a multilevel parenting and family training program originally developed by Matthew R. Sanders and his colleagues at the University of Queensland in Brisbane, Australia (Sanders 1999). Triple P is founded on social learning principles and seeks to shape the home environment by bolstering family protective factors and mitigating risk factors associated with externalizing behavior (Sanders 1999; Malti, Ribeaud, and Eisner 2011).

Sanders (2012) provides a detailed description of the multilevel structure of the Triple P program. Triple P has five intervention levels—universal, selected, primary care, standard and enhanced—that vary in target population, method of intervention, program materials, and targeted behaviors (Sanders 1999). Triple P may also involve universal, targeted, or treatment approaches to intervention (Sanders et al. 2014). Triple P seeks to reduce behavioral and emotional problems in children and adolescents by teaching parents the following core principles of positive parenting:

(1) Safe and engaging environment
(2) Positive learning environment
(3) Assertive discipline
(4) Realistic expectations
(5) Parental self-care

(1) Safe and engaging environment: Triple P explains to parents the importance of creating an environment that allows children to safely play and develop imagination, creativity, and curiosity.

(2) Positive learning environment: Triple P teaches parents how to timely respond to children's requests for help, information, and guidance. Parents learn about techniques to assist children in their decision-making process.

(3) Assertive discipline: Triple P teaches parents noncoercive child management strategies. These strategies rely on constructive discussion techniques instead of ineffective discipline strategies such as shouting or corporal punishment.

(4) Realistic expectations: Triple P providers investigate parents' expectations about child development and behavior. This process allows the program to help parents in setting goals and objectives that are appropriate for them and for their children.

(5) P*arental self-care:* Triple P supports parents in developing parenting strategies that foster personal self-care, well-being, and self-esteem.

In the following tables we investigate the impact of Triple P on educational outcomes. Table A9 studies the effect of being exposed to Triple P versus being unexposed to Triple P. Table A10 analyzes the original 2x2 intervention design. Descriptions of results can be found in the main text and point to the same conclusion: Triple P did not affect educational outcomes.

Table A9: Triple P Treatment

	(1)	(2)	(3)	(4)	(5)
Panel A: No Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
Triple P Treatment	-0.034*	-0.019	-0.029	-0.022	-0.010
	(0.017)	(0.023)	(0.026)	(0.029)	(0.018)
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.074	0.091	0.106	0.106	0.084
Control Group Mean Dependent Variable	.177	.216	.28	.284	.178
Randomization Controls	No	No	No	No	No
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8
Panel B: Randomization Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
Triple P Treatment	-0.011	0.006	-0.001	0.004	0.006
	(0.013)	(0.016)	(0.018)	(0.021)	(0.016)
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.223	0.285	0.295	0.261	0.174
Control Group Mean Dependent Variable	.178	.216	.28	.284	.178
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows the treatment effect of the Triple P intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the self-reported probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. In Panel A, we do not include any controls for baseline characteristics. In Panel B, we include randomization controls for mother's and father's education level. In Panel C, we also include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. In Panel D, we impute missing controls for baseline child, parental, and household characteristics and baseline child SBQ. The imputation process assigns the overall sample mean to each observation with missing information for a continuous control variable and a new missing category to each observation with missing information for an indicator variable. All models in panel D also include indicator variables if a variable is imputed. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A9: Triple P Treatment (continued)

Panel C: Full Set of Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
Triple P Treatment	-0.013	0.004	0.012	0.026	0.017
	(0.019)	(0.018)	(0.019)	(0.021)	(0.021)
Observations	1,011	997	900	837	833
R-squared	0.301	0.364	0.390	0.360	0.245
Control Group Mean Dependent Variable	.227	.278	.329	.325	.204
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8
Panel D: Full Set of Controls (Imputed)	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
Triple P Treatment	-0.005	0.015	0.015	0.022	0.007
	(0.012)	(0.014)	(0.017)	(0.019)	(0.015)
Observations	1,589	1,535	1,305	1,185	1,178
R-squared	0.286	0.348	0.371	0.330	0.231
Control Group Mean Dependent Variable	.177	.216	.28	.284	.178
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows the treatment effect of the Triple P intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the self-reported probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. In Panel A, we do not include any controls for baseline characteristics. In Panel B, we include randomization controls for mother's and father's education level. In Panel C, we also include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. In Panel D, we impute missing controls for baseline child, parental, and household characteristics and baseline child SBQ. The imputation process assigns the overall sample mean to each observation with missing information for a continuous control variable and a new missing category to each observation with missing information for an indicator variable. All models in panel D also include indicator variables if a variable is imputed. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Treatment Effects on Academic High School Completion

Dependent Variable:	Completed Academic High School				
	(1)	(2)	(3)	(4)	(5)
Panel A: PATHS Treatment	No Controls	Randomization Controls	Full Set of Controls	Full Set of Controls (Imputed)	Inverse Probability Weighting
PATHS Treatment	0.023	0.051**	0.071***	0.051**	0.066***
	(0.030)	(0.021)	(0.021)	(0.020)	(0.020)
Observations	1,185	1,185	837	1,185	837
R-squared	0.107	0.265	0.364	0.332	0.366
Control Group Mean Dependent Variable	.269	.269	.308	.269	.308
Randomization Controls	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	Yes	Yes	Yes
Panel B: Triple P Treatment	No Controls	Randomization Controls	Full Set of Controls	Full Set of Controls (Imputed)	Inverse Probability Weighting
Triple P Treatment	-0.022	0.004	0.026	0.022	0.028
	(0.029)	(0.021)	(0.021)	(0.019)	(0.021)
Observations	1,185	1,185	837	1,185	837
R-squared	0.106	0.261	0.360	0.330	0.363
Control Group Mean Dependent Variable	.284	.284	.325	.284	.325
Randomization Controls	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	Yes	Yes	Yes
Panel C: PATHS and Triple P Treatment	No Controls	Randomization Controls	Full Set of Controls	Full Set of Controls (Imputed)	Inverse Probability Weighting
PATHS Treatment	0.028	0.058**	0.056**	0.050**	0.045**
	(0.04)	(0.028)	(0.022)	(0.025)	(0.021)
PATHS * Triple P Treatment	-0.012	-0.013	0.036	0.003	0.049
	(0.06)	(0.045)	(0.045)	(0.042)	(0.044)
Triple P Treatment	-0.015	0.013	0.011	0.022	0.006
	(0.041)	(0.031)	(0.031)	(0.029)	(0.031)
Observations	1,185	1,185	837	1,185	837
R-squared	0.107	0.265	0.365	0.333	0.368
Control Group Mean Dependent Variable	0.295	0.295	0.345	0.295	0.345
Randomization Controls	No	Yes	Yes	Yes	Yes
Additional Controls	No	No	Yes	Yes	Yes

NOTE.—This table shows the treatment effect of the PATHS and Triple P interventions on the probability of completing academic high school. The dependent variable is a self-reported indicator. All models are linear probability models and include strata fixed effects for the level of randomization. "PATHS treatment" is an indicator taking the value of one if a child was only in the PATHS treatment or PATHS and Triple P treatment, while "Triple P Treatment" indicates that a child was only in the Triple P treatment or PATHS and Triple P treatment. "PATHS Treatment*Triple P Treatment" is the interaction between the two variables. Panel A only includes the PATHS treatment indicator, Panel B only includes the Triple P treatment indicator, while Panel C includes both as well as their interaction. In column (1), we do not include any controls for baseline characteristics. In column (2), we include randomization controls for mother's and father's education level. In column (3), we also include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. In column (4), we impute missing controls for baseline child, parental, and household characteristics and baseline child SBQ. The imputation process assigns the overall sample mean to each observation with missing information for a continuous control variable and a new missing category to each observation with missing information for an indicator variable. Models in column (4) also include indicator variables for whether a variable is imputed. In column (5), we weight regressions using the inverse probability of being in the estimation sample. More specifically, the weights are constructed by taking the inverse of predictions from the model estimating attrition using the full set of controls. Child controls include age, gender, and whether the child has Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Robust standard errors clustered at the school level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix Section A4: Additional Information for SBQ and APQ Measures

Table A11: Social Behavior Questionnaire Items (SBQ)

Domain	Survey Items Examples
ADHD symptoms (Disruptive and Impulsive)	Is impulsive, acts without thinking about it Has difficulty awaiting turn in games or groups Cannot sit still, is restless or hyperactive Is squirmy, fidgety Cannot settle to anything for more than a few moments Is distractible, has trouble sticking to any activity Can't concentrate, can't pay attention for long Is inattentive
Opposition and Defiance	Is disobedient Ignores teacher/parents
Non-Aggressive Conduct Disorder	Steals Destroys things/belongings Tells lies and cheats
Anxiety and Depressivity	Cries a lot Is nervous, high-strung, or tense Tends to be overly fearful and anxious Seems worried and concerned Seems sad, unhappy, or depressive Is not as happy as other children Has trouble enjoying him\herself Stares into space Appears miserable, depressed or unhappy
Aggression	When child has been teased or threatened, gets angry easily and strikes back Gets aggressive when contradicted Gets mad when not getting something Gets aggressive when something is taken from him/her Takes part in fights Attacks others physically Kicks, bites, or hits other kids Tortures or tyrannizes others or is mean to others Intimidates or bullies others in order to get his own way Tries to dominate others Threatens others Humiliates others Bosses others around Encourages other children to pick on a particular child
Prosocial Behavior	Volunteers to help clear up a mess someone else has made If there is a quarrel or dispute, will try to stop it Will try to help someone who has been hurt Will invite bystanders to join in a game Spontaneously helps to pick up objects that another child has dropped (e.g., pencils, books, etc.). Comforts a child who is crying or upset Listens to others' points of view Shows sympathy to someone who has made a mistake Is good at understanding other people s feelings Shares with others

NOTE.—This table shows the survey items for each domain measuring social behavior, taken from the Social Behavior Questionnaire. Answers were given on a 5-point Likert scale (1 = "never"; 5 = "always").

Table A12: Validity of SBQ Measures

	Survey Wave	P1	P2	P3	P4	T1.1	T1.2	T2.1	T2.2	T3.1	T4.1	T4.2	T4.3	T5.1	T6.1	T7.1	VT7.1
	Type of Assessment	Home CAPI	Home CAPI	Home CAPI	Home CAPI	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil	Paper & Pencil
	Age (Mean)	7.03	7.94	8.93	11.03	7.45	7.72	8.23	8.65	9.21	10.70	11.60	12.63	13.88	15.67	17.64	17.67
	Date (Median)	10/11/2004	9/15/2005	9/13/2006	9/30/2008	3/29/2005	6/3/2005	1/4/2006	6/3/2006	12/27/2006	6/13/2008	5/7/2009	5/24/2010	8/31/2011	5/24/2013	5/25/2015	5/26/2015
	N all	1230	1191	1181	1073	1349	1171	1343	1298	1294	1269	1064	977	1266	1288	896	615
Prosociality	Alpha	0.766	0.789	0.804	0.829	0.922	0.925	0.923	0.917	0.917	0.911	0.915	0.917	0.929	0.904	0.902	0.899
	N Items	10	10	10	10	7	7	7	7	7	7	7	7	7	7	6	6
	Mean	2.577	2.685	2.669	2.708	2.171	2.220	2.272	2.304	2.396	2.201	2.267	2.269	2.065	2.064	2.040	2.471
	Std.Dev.	0.528	0.527	0.532	0.560	0.824	0.851	0.821	0.810	0.832	0.791	0.834	0.826	0.830	0.786	0.819	0.820
Anxiety and Depressivity	Alpha	0.709	--	0.749	0.787	0.895	0.908	0.909	0.921	0.913	0.903	0.911	0.918	0.913	0.905	0.887	0.871
	N Items	9	--	9	9	7	7	7	7	7	7	7	7	7	7	7	7
	Mean	0.704	--	0.854	0.897	0.871	0.794	0.786	0.821	0.843	0.887	0.899	0.886	0.875	0.869	0.738	0.711
	Std.Dev.	0.464	--	0.494	0.531	0.761	0.726	0.732	0.765	0.739	0.736	0.763	0.773	0.758	0.751	0.671	0.624
ADHD Symptoms	Alpha	0.794	--	0.837	0.852	0.939	0.943	0.946	0.941	0.945	0.947	0.946	0.946	0.945	0.941	0.937	0.896
	N Items	9	--	9	9	8	8	8	8	8	8	8	8	8	8	8	8
	Mean	1.212	--	1.302	1.274	1.246	1.175	1.102	1.049	1.069	1.105	1.073	1.001	1.049	1.036	0.893	0.805
	Std.Dev.	0.646	--	0.674	0.690	0.989	0.990	0.979	0.947	0.953	0.987	0.985	0.944	0.942	0.922	0.850	0.683
Opposition and Defiance	Alpha	0.661	0.707	0.732	0.712	0.865	0.888	0.860	0.845	0.878	0.872	0.871	0.882	0.850	0.841	0.797	0.794
	N Items	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2
	Mean	0.967	1.018	0.989	0.970	0.541	0.529	0.484	0.453	0.509	0.390	0.407	0.463	0.339	0.402	0.270	0.239
	Std.Dev.	0.621	0.618	0.631	0.615	0.815	0.823	0.756	0.719	0.790	0.704	0.718	0.796	0.660	0.702	0.548	0.526
Non-Aggressive Conduct Disorder	Alpha	0.511	0.549	0.602	0.634	0.688	0.773	0.758	0.777	0.781	0.742	0.714	0.741	0.733	0.778	0.491	0.569
	N Items	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4
	Mean	0.296	0.323	0.268	0.276	0.217	0.246	0.221	0.225	0.246	0.213	0.198	0.234	0.180	0.216	0.072	0.108
	Std.Dev.	0.326	0.340	0.324	0.336	0.405	0.463	0.421	0.440	0.461	0.420	0.414	0.456	0.399	0.447	0.197	0.244
Aggression	Alpha	0.789	0.813	0.798	0.811	0.934	0.941	0.934	0.932	0.933	0.940	0.932	0.937	0.929	0.916	0.842	0.831
	N Items	12	12	12	12	11	11	11	11	11	11	11	11	11	11	11	11
	Mean	0.601	0.666	0.652	0.609	0.588	0.614	0.550	0.540	0.575	0.538	0.485	0.479	0.357	0.348	0.162	0.118
	Std.Dev.	0.423	0.442	0.432	0.431	0.684	0.703	0.638	0.628	0.644	0.687	0.630	0.637	0.543	0.508	0.288	0.248

NOTE.—This table provides information on the measurement of the SBQ inventory and Cronbach's Alpha of the respective subdomain.

Table A13: Parenting Practices Survey Items (APQ)

Domain	Survey Item
Corporal Punishment	You spank your child with your hand when he/she has done something wrong
	You slap your child when he/she has done something wrong
	You hit your child with a belt, switch, or other object when he/she has done something wrong
Parental Control and Supervision	Your child fails to leave a note or to let you know where he/she is going
	Your child stays out in the evening past the time he/she is supposed to be home
	Your child is out with friends you don't know
	Your child goes out without a set time to be home
	Your child is out after dark without an adult with him/her
	You get so busy that you forget where your child is and what he/she is doing
	You don't check that your child comes home at the time she/he was supposed to
	You don't tell your child where you are going
	Your child comes home from school more than an hour past the time you expect him/her
	You don't know where your child is out
Inconsistent Discipline	You threaten to punish your child and then do not actually punish him/her
	Your child talks you out of being punished after he/she has done something wrong
	You feel that getting your child to obey you is more trouble than it's worth
	You let your child out of a punishment early (like lift restrictions earlier than you originally said)
	Your child is not punished when he/she has done something wrong
	The punishment you give your child depends on your mood
Parental Involvement	You have a friendly talk with your child
	You volunteer to help with special activities that your child is involved in (such as sports, boy/girl scouts, church youth groups)
	You play games or do other fun things with your child
	You ask your child about his/her day in school
	You help your child with his/her homework
	You ask your child what his/her plans are for the coming day
	You drive your child to a special activity
	You talk to your child about his/her friends
	Your child helps plan family activities
	You attend PTA meetings, parent/teacher conferences, or other meetings at your child's school
Positive Parenting	You let your child know when he/she is doing a good job with something
	You reward or give something extra to your child for obeying you or behaving well
	You compliment your child when he/she does something well
	You hug or kiss your child when he/she does something well
	You tell your child that you like it when he/she helps out around the house

NOTE.—This table shows the survey items for each domain measuring parenting style, taken from the Alabama Parenting Questionnaire (Shelton, Frick, and Wootton 1996). Answers were given on a 5-point Likert scale (1 = "never"; 5 = "very often")

Appendix Section A5: Dosage Effect

We shed light on dosage effects of the intervention and test whether there are larger treatment effects for children who were exposed to the program for a longer period.

Over 70 percent of schools in the treatment group accepted the offer to continue with the program for a second year based on the perception of teachers and school principals that the program was effective. It appears likely that teachers who continued the program were either more successful in the implementation or had students who were more responsive to the program. Whether a student receives the PATHS intervention for one or two years is therefore endogenous and we *cannot* interpret any dosage estimates causally. Nevertheless, we can estimate if longer exposure to the PATHS program is correlated with better outcomes.

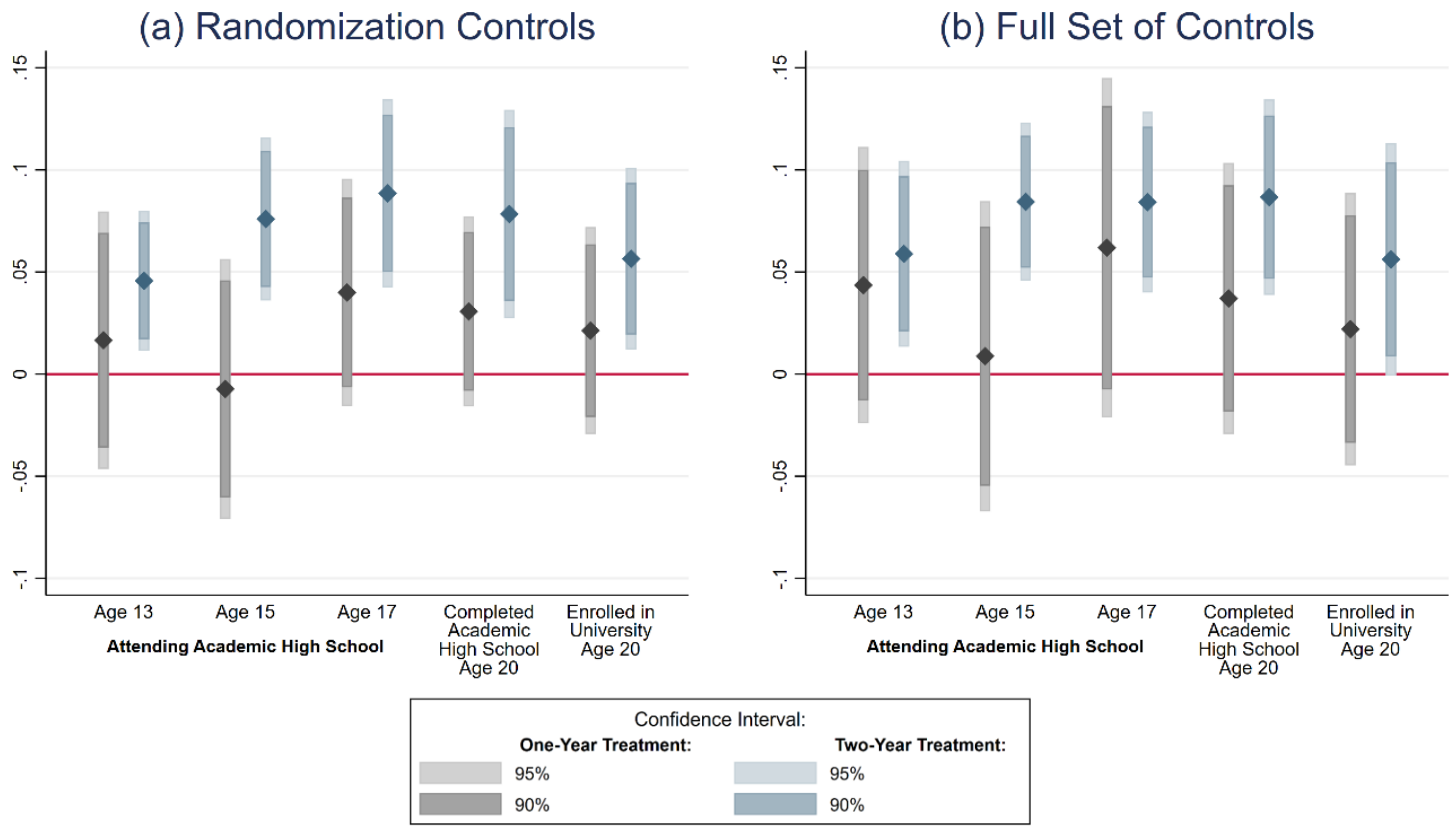
Table A14 shows the analysis of the dosage effect. Figure A7 visualizes the analysis and shows that treatment effect for children exposed to PATHS for two years is approximately twice as large as the effect for children treated for one year. Although we cannot disentangle whether this effect is causal or reflects selection bias, it is encouraging to see that children exposed to the program for a longer time benefit more.

Table A14: Dosage Effects—Two Years vs. One Year of Treatment

	(1)	(2)	(3)	(4)	(5)
Panel A: Randomization Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS 2 Years	0.046**	0.076***	0.088***	0.078***	0.056**
	(0.017)	(0.020)	(0.023)	(0.025)	(0.022)
PATHS 1 Year	0.017	-0.007	0.040	0.031	0.021
	(0.031)	(0.032)	(0.028)	(0.023)	(0.025)
Observations	1,321	1,282	1,121	1,030	1,024
R-squared	0.226	0.289	0.312	0.276	0.174
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8
Panel B: Full Set of Controls	Attending Academic High School Age 13	Attending Academic High School Age 15	Attending Academic High School Age 17	Completed Academic High School (Self-Reported)	Enrolled in University (Self-Reported)
PATHS 2 Years	0.059**	0.084***	0.084***	0.087***	0.056*
	(0.023)	(0.019)	(0.022)	(0.024)	(0.028)
PATHS 1 Year	0.044	0.009	0.062	0.037	0.022
	(0.034)	(0.038)	(0.041)	(0.033)	(0.033)
Observations	933	920	835	777	774
R-squared	0.305	0.370	0.397	0.366	0.246
Randomization Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Child Age	13	15	17	20	20
Survey Wave	Wave 5	Wave 6	Wave 7	Wave 8	Wave 8

NOTE.—This table shows treatment dosage effects of the PATHS intervention on the probability of attending academic high school at ages 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20. All dependent variables are indicator variables and all specifications are estimated using linear probability models. The PATHS treatment effect is separately shown for children who received the treatment for one (*PATHS 1 Year*) or two (*PATHS 2 Years*) years. All models include strata fixed effects for the level of randomization. In Panel A, we include randomization controls for mother's and father's education level. In Panel B, we include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Robust standard errors clustered at the school level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure A7: Dosage Effects—Two Years vs. One Year of Treatment

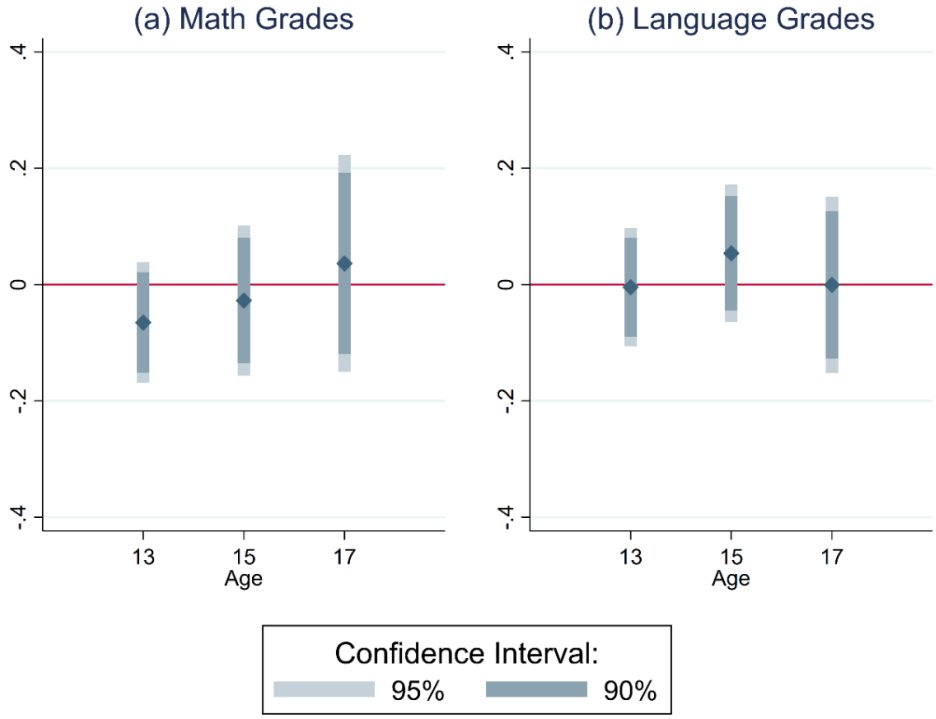


NOTE.—This figure is based on estimates shown in Table A14 and shows the treatment effect of the PATHS intervention for one versus two years on the probability of attending academic high school at ages 13, 15, and 17 as well as on the probability of completing academic high school and being enrolled in university at age 20. Treatment effects are separately shown for children who received the treatment for one (*PATHS 1 Year*) or two (*PATHS 2 Years*) years. All dependent variables are indicator variables and all specifications are estimated using linear probability models. All models include strata fixed effects for the level of randomization. In panel (a), we include randomization controls for mother's and father's education level. In panel (b), we include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. Child controls include age and gender of the child and having Swiss citizenship. Household controls include household income, age of the mother, indicator variables for the mother's having Swiss citizenship and being born in Switzerland, and indicator variables for a single-parent household, a household that received financial aid, and a household that experienced financial problems. Controls for baseline child SBQ measures include measures for anxiety and depressivity, ADHD, non-aggressive externalizing problem behavior, non-aggressive conduct disorder, opposition and defiance, prosociality, four measures of aggressive behavior, and four measures of overall behavior. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

Appendix Section A6: Performance Differences After Tracking

One question that arises from our results is whether the treatment effect creates a potential mismatch between students and secondary schools. Marginal students who got pushed into academic high school by the treatment may perform relatively worse in the more challenging school track. We analyze this question by looking at students' grades in secondary school after tracking has taken place. While grades are determined on a curve and might not be comparable across schools' tracks, this analysis can still provide important information about the relative performance positions of treatment and control children in their respective school. If the treatment causes a mismatch between students and schools, we would expect these children to receive worse grades.

Figure A8: Student-School Mismatch? Effects on Post-Tracking Performance



NOTE.—This figure shows the treatment effect of the PATHS intervention on standardized post-tracking school grades from ages 13–17. The dependent variable in panel (a) is a student's grade in mathematics. The dependent variable in panel (b) is a student's grade in language. All dependent variables are indices standardized with a mean of zero and a standard deviation of one. All models include strata fixed effects for the level of randomization. All models include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.

Figure A8 (panel a and panel b) shows the treatment effect for standardized math and language grades at ages 13, 15, and 17. The figure shows that the treatment does not affect math or language grades in secondary school. Treated and untreated children perform similarly during secondary school. This similarity seems to confirm that the intervention did not lead to a mismatch between students and secondary schools. The intervention caused children to enter more-demanding school tracks without reducing their relative performance within these schools. Once tracked, they do not underperform in comparison to the control group. These results are consistent with the persistence of the treatment effect in secondary school documented in Figure 3.

Appendix Section A7: Mediation Analysis

We perform a mediation analysis in the spirit of Heckman and Pinto (2015) and Gelbach (2016). This analysis provides insights on the relative importance of different mechanisms (mediators) in shaping the PATHS treatment effect on the education outcomes. This analysis allows us to quantify the proportion of the treatment effect mediated by all our proposed mechanisms and to separate the contribution of each single mechanism to the estimated treatment effect.

The results of the mediation analysis should be interpreted with caution. Imai, Keele, and Tingley (2010) show that to be able to interpret this type of analysis causally one needs to make strong assumptions about the source of variation of the mediators. As we lack exogenous variation in specific channels and have to rely on a single source of exogenous variation (one randomization), this analysis can only provide suggestive evidence on the importance of different mediators in explaining treatment effect. Despite these limitations, we believe that this analysis is helpful to see whether the mechanism we study explain treatment effects.

We perform the mediation analysis for the following education outcomes: attendance of academic high school at ages 13, 15, and 17, academic high school completion, and university enrollment at age 20. As possible mediators, we focus on socio-emotional skills, parenting practices and classroom behavior. The set of mediators includes all variables analyzed as potential mechanisms in Sections 7 except grades and test scores because these variables are only available for a subsample of students that sit for the standardized academic high school admission test. We aggregate all candidate mechanisms into three domains: (1) socio-emotional skills, (2) parenting practices, (3) and classroom behavior. Given the longitudinal nature of our data, we only consider measures obtained after the intervention and before the educational outcome is measured. In cases in which we have multiple observations for the same mediator, we construct a summary index using the covariance weighting procedure discussed in Anderson (2008). We assume that the PATHS treatment has both direct and indirect effects on education outcomes. The indirect effects run through treatment effects of the intervention on socio-emotional skills, parenting practices, and classroom behavior. The results of the mediation analysis will give us an estimate of the importance of these indirect effects.

We perform the mediation analysis by decomposing the treatment effect obtained from estimates of the unconditional outcome equation $Y_{is} = \beta_1 \text{PATHS}_s + X'_{is}\gamma + \theta + \varepsilon_{is}$ (Equation 1) in the following way:

$$\frac{dY}{dPATHS} = \sum \frac{\partial Y}{\partial M}\frac{\partial M}{\partial PATHS} + R,$$

where Y is the outcome, $PATHS$ is the treatment indicator, M is a vector of k mediators, and R is the unexplained part of the treatment effect. We estimate two additional specifications. First, we estimate the conditional outcome equation augmented with the vector M:

$$Y_{is} = \beta_2 \text{PATHS}_s + M_{is}\varphi + X'_{is}\gamma + \theta + \epsilon_{is}.$$

Second, we separately estimate the treatment effect of the intervention on each mediator $j \in k$:

$$M^j_{is} = \beta^j_3 \text{PATHS}_s + X'_{is}\gamma + \theta + v_{is}.$$

The contribution of each mediator $j \in k$ is then computed as the ratio $\frac{\varphi^j \times \beta^j_3}{\beta_1}$. The unexplained part, R, results from $R = 1 - \sum_{j=1}^{k} \frac{\varphi^j \times \beta^j_3}{\beta_1}$.

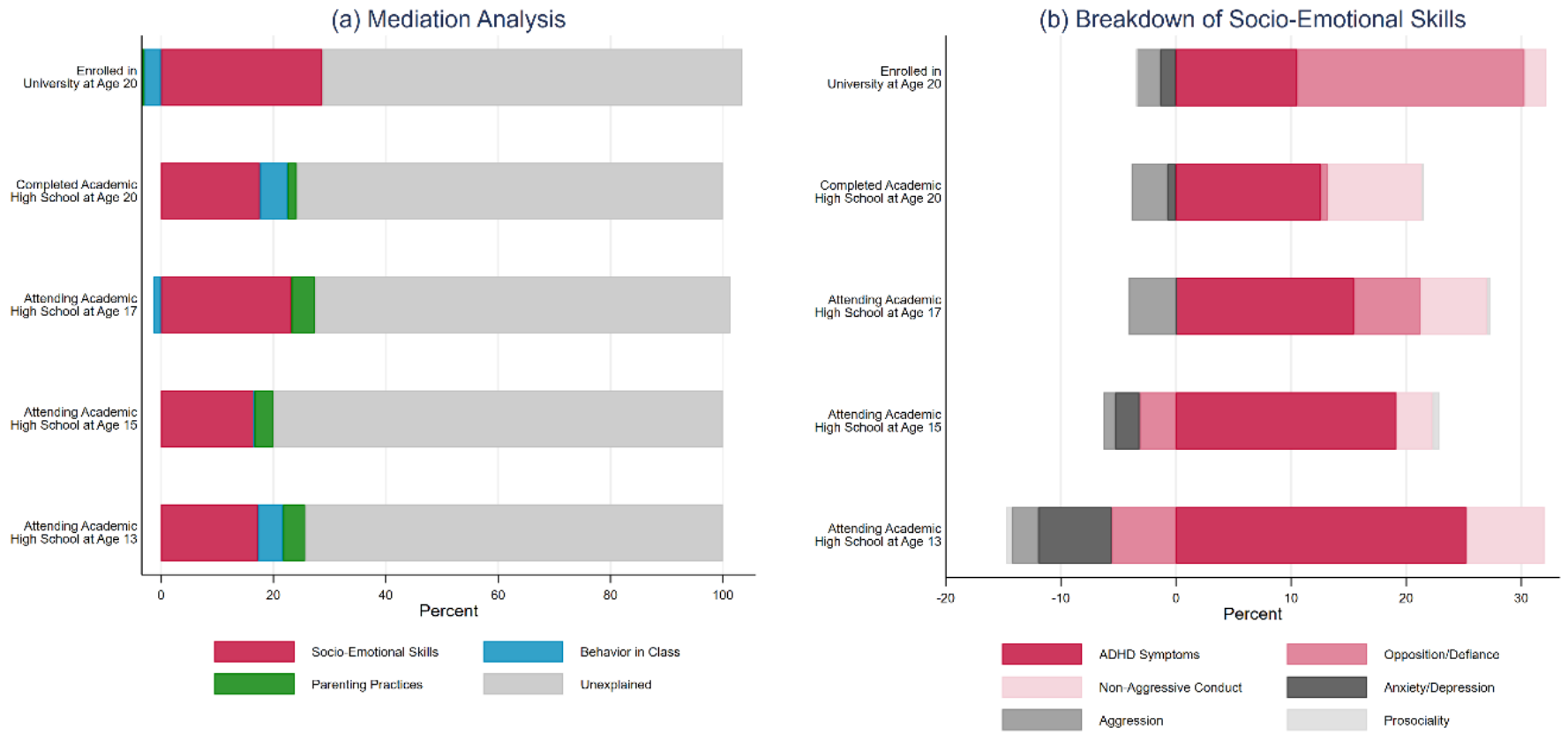
Panel (a) of Figure A9 shows the results of the mediation analysis. Each horizontal bar represents a specific outcome of interest. Colored areas within the bars illustrate the contribution of each mediator to the overall treatment effect. The grey area stands for the unexplained share of the treatment effect. The mediation analysis highlights that our candidate mechanisms explain about 20–26 percent of the treatment effect. Among the mechanisms we study, socio-emotional skills appear as the most important mediator of the PATHS treatment effect. For example, socio-emotional skills explain about 25 percent of the PATHS treatment effect on university attendance at age 20. The contribution of parenting practices and classroom behavior are smaller and less stable across different outcomes, suggesting that these are not important mechanisms.

Given the important mediating role of socio-emotional skills, we investigate the contribution of each of the following six separate skills: opposition and defiance, non-aggressive conduct disorder, anxiety and depressivity, aggression, and prosociality and ADHD symptoms. Panel (b) of Figure A9 shows the results of this mediation analysis. The main mediator is reduction of ADHD symptoms. This variable explains up to 25 percent of the PATHS treatment effect on educational outcomes. The relative importance

of its mediating role is similar across outcomes and does not depend on the children's age. Non-aggressive conduct disorders and opposition/defiance are also relevant mediators, but quantitatively less important. Their mediating role is also less stable over time. The remaining socio-emotional skills seem to have a negligible role as mediators (prosociality) or have a negative load as mediators (anxiety and aggression).

Taken together, the mediation analysis described in this section suggests that the PATHS treatment effect on educational outcomes is driven by treatment-induced improvements in children's socio-emotional skills, in particular, by reductions in ADHD symptoms—impulsiveness and disruptiveness.

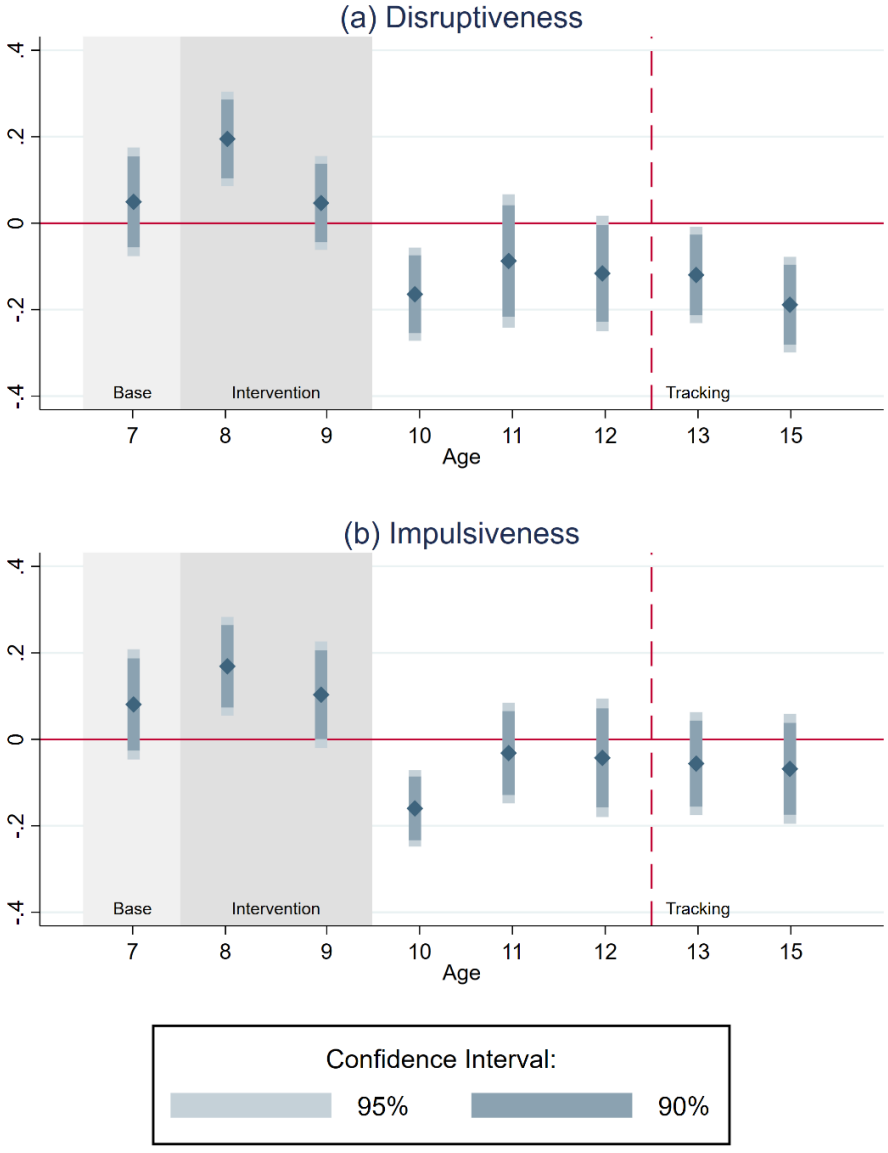
Figure A9: Mediation Analysis



NOTE.—This figure shows the results of our mediation analysis. Panel (a) shows the decomposition of the overall treatment effect. In panel (a) we include socio-emotional skills, parenting practices, and behavior in class as mediators. Panel (b) shows the decomposition of socio-emotional skills. We decompose the treatment effect obtained from the *unconditional* outcome equation $Y_{is} = \beta_1 \text{PATHS}_s + X'_{is}\gamma + \theta + \varepsilon_{is}$ shown in equation (1) in the following way: $\frac{dY}{dPATHS} = \sum \frac{\partial Y}{\partial M}\frac{\partial M}{\partial PATHS} + R$, where Y is the outcome, $PATHS$ is the treatment indicator, M is a vector of k mediators (comprised of the variables included in socio-emotional skills, parenting practices, and behavior in class), and R is the unexplained part of the treatment effect. We estimate two additional specifications. First, we estimate the *conditional* outcome equation augmented with the vector M: $Y_{is} = \beta_2 \text{PATHS}_s + M_{is}\varphi + X'_{is}\gamma + \theta + \epsilon_{is}$. Second, we separately estimate the treatment effect of the intervention on each mediator $j \in k$: $M^j_{is} = \beta^j_3 \text{PATHS}_s + X'_{is}\gamma + \theta + v_{is}$. Given the longitudinal nature of our data, for all mediators we only consider measures obtained post-treatment and before the education outcome is measured. In case of multiple observations for the same mediator, we construct a summary index using the covariance weighting procedure discussed in Anderson (2008). The contribution of each mediator $j \in k$ is then computed as the ratio $\frac{\varphi^j \times \beta^j_3}{\beta_1}$, which is shown in the color-coded bars. The unexplained part, R, results from $R = 1 - \sum_{j=1}^{k} \frac{\varphi^j \times \beta^j_3}{\beta_1}$.

Appendix Section A8: Attention Deficit and Hyperactivity Symptoms

Figure A10: Treatment Effects on Attention Deficit and Hyperactivity Symptoms



NOTE.—This figure shows the treatment effect of the PATHS intervention on children's socio-emotional skills from ages seven through 15. The dependent variable in panel (a) is disruptiveness. The dependent variable in panel (b) is impulsiveness. All dependent variables are indices standardized with a mean of zero and a standard deviation of one. All models include strata fixed effects for the level of randomization. All models include controls for baseline child, parental, and household characteristics and baseline child SBQ measures. To provide evidence on balance across the treatment and the control groups, we do not include individual controls in the estimation of the treatment effect at age seven. For each SBQ measure, we combine measures from teacher and parent reports by taking the average of the two standardized indices and standardizing the resulting index again. For measures at ages 10, 12, 13, and 15, we rely solely on teacher reports, as there are no parent surveys at these times. Details on the SBQ items and construct validity are provided in Appendix Section A4. Shaded areas indicate the baseline and the intervention periods. The dashed vertical line shows the time when tracking into secondary schools takes place. Each point estimate is shown with the respective 90 and 95 percent confidence intervals calculated based on standard errors clustered at the school level.